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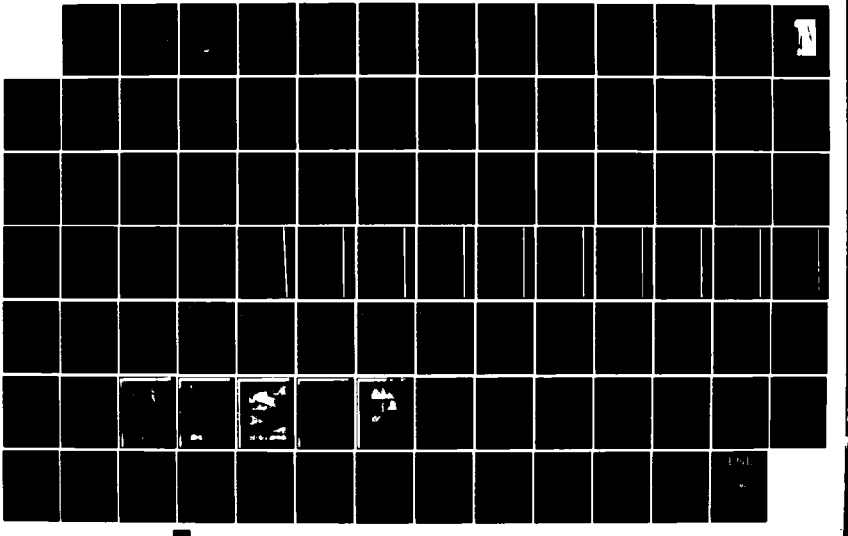

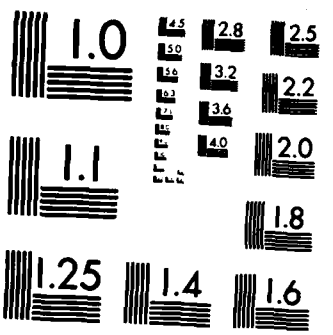

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AD-A154 344

THAMES RIVER BASIN
HOLLAND, MASSACHUSETTS

HAMILTON RESERVOIR DAM
MA 00536

PHASE 1 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

NOVEMBER 1978

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18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Thames River Basin
Holland, Massachusetts
Quinebaug River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is an earthfill embankment and concrete spillway dam. It is about 100 ft. long andhas a maximum height of 17 ft. The project is considered to be in good condition. It is intermediate in size with a significant hazard potential.. It is recommended that the owner retain a competent consulting engineer to conduct further studies to determine the measures that are necessary to improve the discharge capacities.

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HAMILTON RESERVOIR DAM
MA 00536

THAMES RIVER BASIN
HOLLAND, MASSACHUSETTS

PHASE 1 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Inventory No.:	MA 00536
Name of Dam:	HAMILTON RESERVOIR DAM
Town Located:	HOLLAND
County Located:	HAMPDEN
State Located:	MASSACHUSETTS
Stream:	QUINEBAUG RIVER
Date of Inspection:	27 OCTOBER 1978

BRIEF ASSESSMENT

Hamilton Reservoir Dam is a combined earthfill embankment and concrete spillway on the Quinebaug River, a tributary of the Thames River. The earthfill embankment is about 100 feet long with a crest width varying from 4 feet to 20 feet and a maximum height of 17 feet. The spillway which is ogee shaped, is 150 feet long, 11 feet high with 5 feet of freeboard. An intake structure with a low level outlet sluiceway is located at the contact between the embankment and the spillway. The downstream channel, adjacent to the spillway, is a concrete stepped apron, and is followed by a zone of riprap.

Phase I investigation of Hamilton Reservoir Dam does not indicate conditions which would constitute an immediate hazard to human life or property. Based on engineering judgment and the performance of the embankment, the spillway and the low level outlet, the project is considered to be in good condition. The project, however, does have inadequacies and deficiencies which, if not remedied, have the potential for developing into hazardous conditions.

Because the dam is classified as intermediate in size, with a significant hazard potential, the test flood in accordance with Corps of Engineers guidelines, is one half the Probable Maximum Flood (1/2 PMF). The resulting inflow, as developed by summing the 1/2 PMF hydrograph ordinates for the drainage basin land area and the corresponding runoff rates, is 12,710 cfs. Routing the Test Flood through the reservoir using a computer routing technique results in a rise of the reservoir to El 689.06 or 1.06 feet above the top of the dam. The total outflow corresponding to the Test Flood maximum elevation is

8,994 cfs of which only 69% could be passed by the spillway. Since the dam will be overtopped by the Test Flood, it is considered that the spillway is inadequate from a hydraulic and hydrologic standpoint.

It is recommended that within 12 months of receipt of this Phase I Inspection Report the owner retain a competent consulting engineer to conduct further studies to determine the measures that are necessary to improve discharge capacities.

In addition, remedial measures are recommended for implementation by the owner within 24 months of receipt of this Phase I Inspection Report to improve overall conditions. These measures, in general, are to establish formal programs of operation, maintenance and inspection of the dam.

Eugene O'Brien, P. E.
New York No. 29823

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

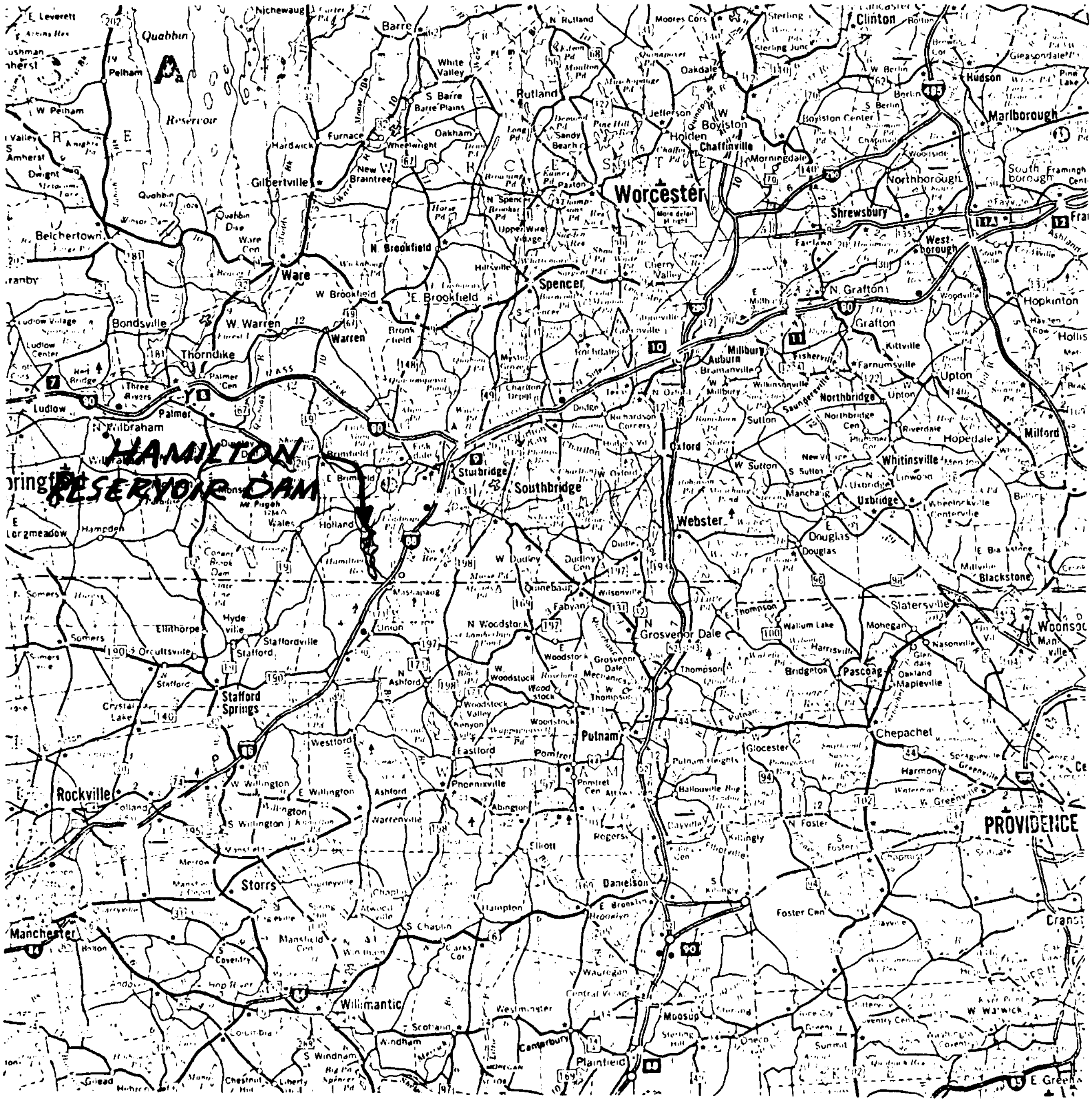
It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

THAMES RIVER BASIN
HAMILTON RESERVOIR DAM
INVENTORY NO. MA 00536
PHASE I INSPECTION REPORT

CONTENTS

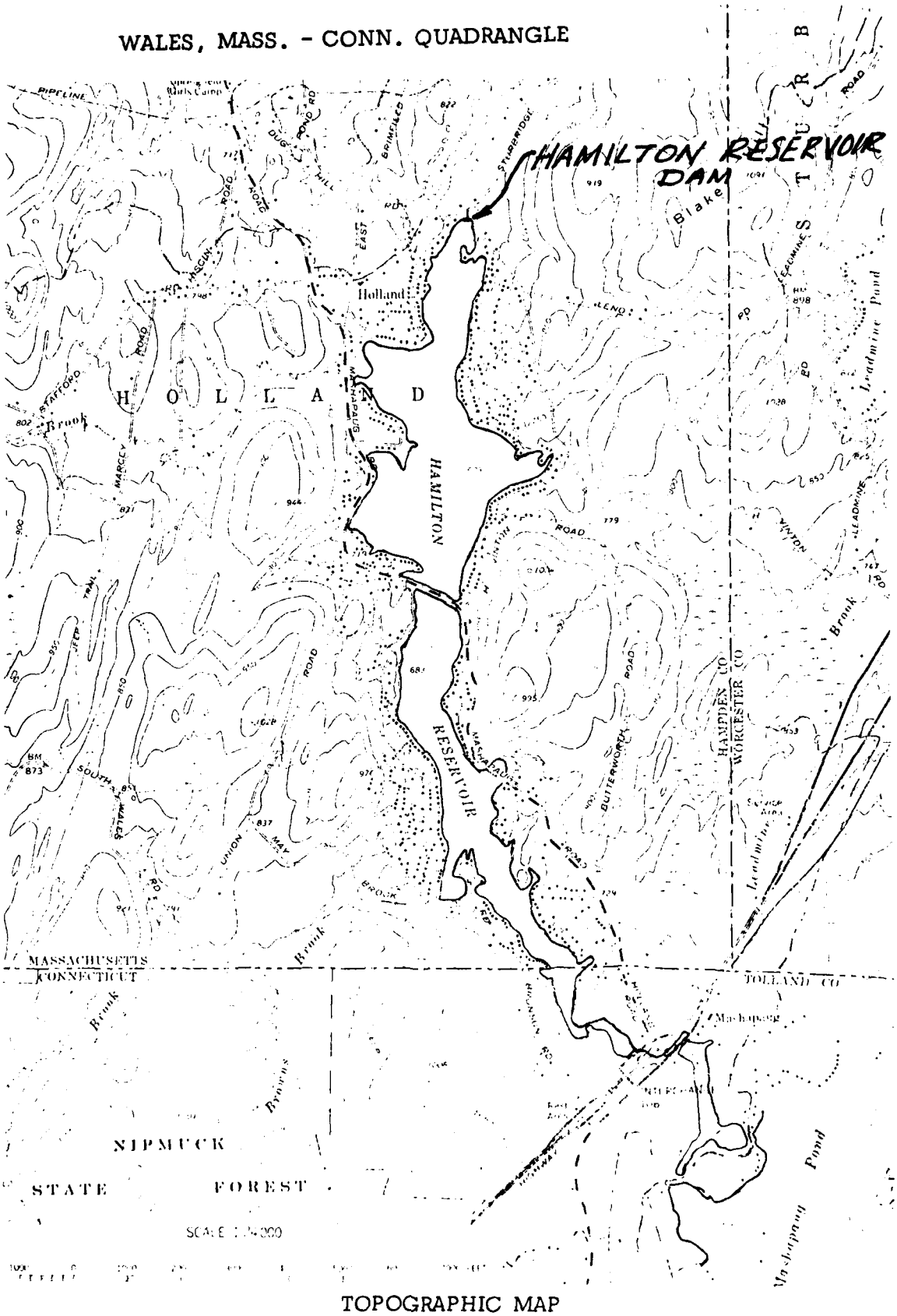
APPENDICES (Cont'd)

1. GENERAL OVERVIEW OF DAM.



VICINITY MAP
HAMILTON RESERVOIR DAM

WALES, MASS. - CONN. QUADRANGLE



TOPOGRAPHIC MAP
HAMILTON RESERVOIR DAM

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
THAMES RIVER BASIN
INVENTORY NO. MA 00536
HAMILTON RESERVOIR DAM
TOWN OF HOLLAND
HAMPDEN COUNTY, COMMONWEALTH OF MASSACHUSETTS

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Tippetts-Abbett-McCarthy-Stratton has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed was issued to Tippetts-Abbett-McCarthy-Stratton under a letter of May 3, 1978, from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW 33-78-C-0298 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and prepare the States to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 DESCRIPTIONS OF THE PROJECT

a. Description of Dam and Appurtenances

Hamilton Reservoir Dam is a combined earthfill embankment and concrete spillway. The earthfill portion of the dam has a crest length of about 100 feet with a maximum height of about 17 feet. The crest width varies from about 4 to 20 feet and the upstream slope varies from 1V on 2.5H to 1V on 4H. The downstream slope is 1V on 2H. The crest and downstream slope are grassed

and the upstream slope is grassed and riprapped.

The concrete spillway is ogee shaped, 150 feet long with a maximum drop height of 11 feet and a freeboard of 5 feet. (See Photograph No. 3). Flanking the spillway are two training walls. On the right abutment, upstream and downstream of the crest, the wall is concrete, 105 feet long with a maximum height of 14 feet. (See Photograph No. 7). On the left side, the upstream wall is the riprapped slope of the earthfill embankment. Downstream the wall is concrete, stone and stone masonry, curved and about 80 feet long. (See Photograph Nos. 4 and 5). A reinforced concrete intake structure is located at the contact between the spillway and the earthfill embankment. The structure is 22 feet high, 12 feet long and 7.5 feet wide. An uncontrolled intake opening, 8 feet high, 4.5 feet wide, is protected by a steel trash rack. The low level outlet, located at the base of the structure, is a sluiceway 4 feet high, 2 feet wide. Discharges through the sluice are controlled by a manually operated center-rising screw type stemmed sluice gate. Two 12 inch square, high level uncontrolled outlets with ogee shaped lips are located on the downstream face of the structure. (See Photograph No. 6).

Three concrete apron slabs are located at the base of the spillway and are stepped parallel to the base. A concrete curbing is located at the downstream edge of the slabs and creates a three level plunge pool. (See Photograph No. 3). Downstream of the plunge pool the channel is riprapped with large placed stone. The channel flows under Sturbridge Road through about a 17 feet wide bridge opening and three 36 inch diameter asphalt covered corrugated metal pipe conduits. The channel beyond the road is the natural Quinebaug River.

b. Location

The dam is located in the Town of Holland, near the intersection of Sturbridge Road, Leno Road and Dug Hill Road.

c. Ownership

Hamilton Reservoir Dam is owned by the Town of Holland. The day-to-day operation and maintenance is managed by the Department of Public Works, Town of Holland.

d. Purpose of Dam

The impoundment provided by the dam is for recreational purposes.

e. Design and Construction History

The present dam, designed by Tighe and Bond, Inc., Holyoke, Mass., was built and completed about 1960. The dam was constructed to replace an original dam which had been destroyed by a 1955 flood.

The original dam, which had been constructed to provide water power to the Hamilton Woolen Co. mill, consisted of a rubble dam and spillway, and a gatehouse. The spillway and gatehouse were demolished and replaced by the present larger spillway and concrete gatehouse (intake structure). The rubble dam remained, but was covered over by the existing earthfill embankment. On the right side of the dam the alignment of Leadmine Road was moved about 60 feet to the east, to its present location. This was done to accommodate the enlarged spillway. As a result of the relocation, the right abutment had to be regraded. There are no construction records available for this work.

f. Normal Operating Procedures

The normal operating procedure is to maintain the reservoir level at spillway crest during the summer months and to draw down the reservoir level in the fall and in the winter. However, it is reported that should the reservoir level be lowered by more than 32 inches, local wells tend to become dry. Therefore, the reservoir is never drawn down below this level.

g. Size Classification

The dam is less than 40 feet high and has a maximum storage capacity of over 1000 acre-feet but less than 5000 acre-feet. It is, therefore, classified as an "intermediate" dam.

h. Hazard Classification

The dam is in the significant hazard potential category because downstream of the dam there are only 3 or 4 houses and three minor roadway crossings which could be damaged in the event of a dam failure.

For details on the selection of the hazard potential category see Section 5.1d.

i. Operator

The individual responsible for the day-to-day operation of the dam is:

Mr. Walter Woods
Superintendent of Public Works and
Civil Defense Director
Department of Public Works
Town Hall
Holland, Massachusetts
Telephone No. (Office) 413-245-3276
(Home) 413-245-7597

1.3 PERTINENT DATA

a. Drainage Area

The total drainage area contributing to the Hamilton Reservoir is 11,536 acres (18.03 square miles) including the 426 acres of the reservoir, which is 3.7% of the total area. The drainage area adjacent to the reservoir is wooded with relatively short length parallel tributaries having an elevation differential of up to 630 feet.

b. Discharges at Damsite

Discharges at the damsite are over an uncontrolled concrete spillway, a controlled low level outlet sluiceway and two high level uncontrolled outlets.

The spillway is 150 feet long, with a drop of 11 feet and a freeboard of 5 feet. The computed maximum discharge capacity with the reservoir level at the top of the dam, El 688, is 6205 cfs.

The low level outlet sluiceway is 4 feet high, 2 feet wide and discharges are controlled by a manually operated sluice gate. The computed maximum discharges, with a head equivalent to the spillway crest, El 683, and top of the dam, El 688 are 106.0 cfs and 140 cfs respectively. The two high level outlets are each 12 inch square openings with ogee shaped lips. The discharge through these openings with a head equivalent to spillway crest is minimal. The computed discharge with a head equivalent to the top of dam, El 688 is 6345 cfs.

There is no official record of the maximum flood at the damsite. It is reported, however, that in the 1955 flood, which destroyed the original dam, the water level was about 2 feet above Mashapaug Road, which crosses the reservoir on a causeway.

c. Elevation (ft. above MSL)

Top of dam	688
Maximum pool-design surcharge (100 yr flood)	686.5
Maximum pool-test flood	689.06
Full flood control pool	Not Applicable
Recreation pool	683
Spillway crest (gated)	Not Applicable
Upstream portal invert diversion tunnel	Not Applicable
Downstream portal invert diversion tunnel	Not Applicable
Streambed at centerline of dam	671±
Maximum tailwater	Unknown

d. Reservoir (feet)

Length of maximum pool	20500
Length of recreation pool	20500
Length of flood control pool	Not Applicable

e. Storage (acre-feet)

Recreation pool (gross)	1918
Flood control pool	Not Applicable
100 Yr. flood design surcharge (net)	1561
Test flood surcharge (net)	2827
Top of dam (gross)	4200

f. Reservoir Surface (acres)

Top of dam	496.7
Test flood pool	516
Flood-control pool	Not Applicable
Recreation pool	416
Spillway crest	416

g. Dam

Type	Earthfill
Length, feet	100±
Height, feet	17±
Top width, feet	Varies from 4 to 20
Side Slopes - U/S	Varies from 1V on 2.5H to 1V on 4H
D/S	1V on 2H
Zoning	See below
Impervious core	Remnants of old rubble dam
Cutoff	None
Grout curtain	None

h. Diversion and Regulating Tunnel

Type	Not Applicable
Length	Not Applicable
Closure	Not Applicable
Access	Not Applicable
Regulating facilities	Not Applicable

i. Spillway

Type	Ogee
Length of weir, feet	150
Crest elevation, feet	683
Gates	None
U/S channel	None
D/S channel	Concrete apron; riprap; natural brook

j. Regulating Outlets

The regulating outlets consists of an uncontrolled spillway and a low level outlet system.

The uncontrolled spillway (crest El 683) is 150 feet long, drop distance of 11 feet and freeboard of 5 feet.

The low level outlet system consists of a reinforced concrete intake structure, 22 feet high, 12 feet long and 7.5 feet wide. A low level outlet sluiceway, 4 feet high by 2 feet wide, with invert at El 674 is equipped with a manually operated sluice gate which is operable.

The uncontrolled two high level outlets are each 12 inches square openings with ogee shaped lips at El 682.5.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

Design data and specific memoranda dealing with the construction of the dam were not available for this evaluation. There are, however, two sets of contract drawings, dated 1957 and 1959, which cover the reconstruction of the spillway, gatehouse (intake structure) and embankment. The earlier set of drawings shows plan, sections and details of the spillway and is included in the Appendix. The later set of drawings, which show plan, sections and details of the gatehouse and embankment are available at the Town Clerk's Office, Town Hall, Holland, Mass. A list of titles for these drawings is given in the Appendix. In addition, a sketch of the dam, plan and section, from a previous inspection report is included in the Appendix. A few discrepancies in dimensions are noted between the drawings, the sketch and actual field conditions. For example, the top of dam, shown on the 1957 drawings, indicates El 687.5, whereas, as observed, the top of dam is level with the top of the intake structure El 688.

Information regarding subsurface conditions is available from eight borings; the logs are given in the 1957 contract drawings.

2.2 CONSTRUCTION RECORDS

There are no construction records available.

2.3 OPERATION RECORDS

Operation of the low level sluice gate and the reservoir levels are recorded after each gate operation. These records are available at the Public Works Department.

No records are kept of the rainfall at the damsite.

2.4 EVALUATION OF DATA

a. Availability

Existing information was made available by the Town Clerk's Office and the Department of Public Works, Town of Holland; County Commissioner's Office, Hampden County, Springfield, Mass; Department of Environmental Quality Engineering, Division of Waterways, Boston, Mass.

b. Adequacy

The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing the design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgment.

c. Validity

In general, the information obtained from the above mentioned drawings, sketches and personal interviews, with noted exceptions, is consistent with observations made during the inspection and, therefore, considered reliable.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

A visual inspection of Hamilton Reservoir Dam was conducted on 27 October 1978. The weather was sunny, temperature between 60° and 70°F. The last rainfall occurred the previous day. At the time of the inspection the reservoir level was 15 inches below the crest of the spillway.

b. Embankment

The earthfill embankment appears to be in generally good condition. The horizontal and vertical alignments of the crest are good. The crest is grassed and well maintained.

The upstream slope is in generally good condition. The stone riprap is sound with some tall grass growing through it. There are no signs of trespassing, sloughing or erosion, (See Photograph No. 5).

The downstream slope is in generally good condition. The grass is cut, however, there are about four ten foot tall evergreens and a few small fruit trees which have been planted by the owner of the house adjacent to the embankment. (See Photograph No. 4).

c. Spillway

The spillway appears to be generally in good condition. The concrete appears to be sound, with little to no spalling. Some minor repair work to the concrete reportedly was performed about 10 years ago. It consisted of patching small areas of concrete which had broken off at the vertical construction joints on the face of the spillway. The crest of the spillway is in good condition with no observed debris. (See Photograph Nos. 2 and 3).

The area of the downstream apron appears to be in good condition. The concrete appears sound; some large gravel and small boulders were observed on the apron.

d. Appurtenant Structures

The right abutment concrete training wall is in good condition. The concrete is sound with no spalled surfaces observed. Several of the weep holes located at the base of the wall were running water. The left downstream training wall is in good condition. The lower stone portion of the wall is sound with minimal vegetation growing out of the joints. The upper stone masonry portion

of the wall is in good condition. (See Photograph No. 7).

The intake structure is in good condition, the concrete is sound and free of spalled areas. There was no debris, other than some leaves observed at the trash rack. The operating stand is in good condition. (See Photograph No. 10). The operating handle was not in place, but reportedly is kept at the Public Works Dept. At the time of the inspection, the sluice gate was operable and open about two or three inches and the discharge did not appear to be impeded. (See Photograph No. 6).

The top of the structure is enclosed by an anchor fence which has a locked gate. The fence is in good condition.

e. Abutments

There were no signs of seepage or other unusual conditions at the abutments.

f. Downstream Channel

The channel, downstream of the apron area, passes under Sturbridge Road through a bridge opening and three conduits into a natural channel. The channel which is about 20 feet wide is clear, free of debris and there are only a few overhanging trees growing on its banks. Some minor debris was observed in the vicinity of the downstream end of the conduits. (See Photograph Nos. 8 and 9).

g. Reservoir Area

In the vicinity of the dam there is no evidence of sloughing or potentially unstable slopes which could adversely affect the dam.

At the south end of the reservoir, in the vicinity of I-86, just over the Connecticut border, are two ponds. The larger is Mashapaug Pond and the smaller is commonly known as Upper Mashapaug Pond. The two ponds are separated by a short embankment containing a control structure. At the time of the inspection, the control structure, which could not be seen, apparently was closed since the level of Upper Mashapaug Pond was substantially lower than Mashapaug Pond. Information regarding the owner, the function and the operation of the embankment and control structure was not available.

The normal level of Upper Mashapaug Pond, with the control structure closed, is maintained by a concrete overflow weir whose crest is about 4 feet higher than the spillway level of Hamilton Reservoir. The weir is located between the southbound lanes of I-86 and the access road to Interchange 106. The weir contains a low level outlet pipe, which at the time of the inspection

was closed. (See Topographic Map, Page v).

3.2 EVALUATION OF OBSERVATIONS

Visual observations made during the course of the investigation revealed a few deficiencies which at present do not adversely affect the adequacy of the dam. However, these deficiencies do require attention and should be corrected before further deterioration leads to a hazardous condition. Recommended measures to improve these conditions are given in Section 7.

SECTION 4 - OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

Operational procedures for the project are not formally established. The low level outlet gate is operated as required to maintain the reservoir level at spillway crest during the summer and 32 inches below spillway crest during the fall.

4.2 MAINTENANCE OF DAM

There is no formal maintenance manual for the project. It is reported that the grass is cut twice a year. There is no scheduled program of inspection by the Town. It is reported that the dam is "looked at" by the Town's Department of Public Works once or twice a year. There is, however, a statewide program of inspection which was established several years ago by the Department of Environmental Quality Engineering, Division of Waterways. Copies of their latest reports, dated July 23, 1970, and August 1, 1972, are included in the Appendix.

4.3 MAINTENANCE OF OPERATING FACILITIES

There is no established maintenance program for the operating facilities. Maintenance is carried out as needed.

4.4 WARNING SYSTEMS IN EFFECT

There is no warning system in effect.

4.5 EVALUATION

The maintenance and operating procedures for the dam and appurtenant structures are, in some respects, inadequate. Measures to improve these inadequacies are given in Section 7.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data

No design data are available. The reservoir is created by an earth-fill embankment and a concrete spillway located on Quinebaug River in the Town of Holland. The entire drainage area contributing runoff to the Hamilton Reservoir is 11,536 acres (18.03 square miles) including the reservoir which covers 426 acres (3.7%) of the total drainage area. Storm runoff from about 13.7% of the total drainage area is subject to attenuation affected by the Leadmine Pond and extensive swamp areas northeast and south of the Pond. Outflow from these ponding areas is controlled by a natural narrow crossing of the Leadmine Brook and subsequently by the culvert built to cross under the Wilbur Cross Highway (I-86). The existence of storage and flow control features and/or structures results in retarding and reducing the flood peak contributed by the portion of the Leadmine Brook watershed. Considering that the reduced outflow from Leadmine Brook would contribute very minor amounts to the peak flow entering Hamilton Reservoir, it is omitted in the subsequent analysis.

The remaining drainage area is adjacent to the two sides of the reservoir which is wooded and contains tributaries of relatively short length with an elevation differential of up to 630 feet. The tributaries enter the lake in parallel and almost simultaneously. The expected effect of these topographic features on flood runoff is a relatively higher and earlier peak than is normally encountered in the watersheds of comparable size. The reservoir is divided into approximately two equal parts by Mashapaug Road with an interconnection of the reservoirs provided by means of a 9 by 11.5 feet corrugated metal pipe arch. In the subsequent analysis it is assumed that the pipe arch is large enough to maintain pool equilibrium between the two parts of the reservoir and thus acts as one unit. Similar assumptions were made for the Wilbur Cross Highway crossing at the upper (Southern) end of the reservoir where an existing control weir would be submerged in the event of the Test Flood. For the purposes of this study it was also assumed that any conduit communication between Upper Mashapaug and Mashapaug Ponds would not be operative during the Test Flood.

b. Experience Data

It is reported by persons interviewed that during the 1955 flood the right abutment was breached and the old spillway was destroyed. Extensive damage also was sustained by the embankment and the abutments to the Sturbridge Road bridge immediately downstream of the dam. Much of this information is corroborated by the available contract drawings (See Appendix) which were used for the restoration of the project.

c. Visual Inspection

At the time of the inspection, the reservoir level was 15 inches below the crest of the spillway. The spillway, training walls, intake structure, embankment and downstream channel were in generally good condition. Some minor deficiencies were observed, for details see Section 3.1c.

d. Overtopping Potential

The structure, based on its reported[1]* maximum impoundment, is in the "intermediate" size category. A small number (3 or 4) of homes and three minor roads cross between Hamilton Reservoir and Holland Pond and could sustain damage in the event of a dam failure. Therefore, the dam is in the "significant" hazard category. This conclusion was arrived at using the Corps of Engineers' "Rule of Thumb" for Estimating Downstream Dam Failure Hydrographs, as follows:

A breach equivalent to 40% of dam length (107 feet) and a channel roughness of 0.07 was assumed. The hypothetical flood wave height was estimated at locations 1000, 2500, 3600, 4400 and 6000 feet downstream from the dam. The following results were obtained:

Distance From Dam (ft)	Wave Height (ft)	Flood Elev. (ft)	Flood Discharge (cfs)
1000	11.8	676.8	12,489
2500	12.2	668.2	12,300
3600	11.5	664.5	11,993
4400	9.3	654.3	11,908
6000	11.2	647.2	11,614

At the investigated distances a few isolated homes would be subjected to about a 50 feet high flood wave as a result of a hypothetical dam breach. Beyond 5750 feet the storage in Holland Pond and in the extensive swamp area surrounding it is likely to attenuate considerably the effect of such a flood wave. Since the dam is classified as intermediate in size, with a significant hazard potential, the Test Flood, in accordance with Corps of Engineers' guidelines, is one-half the Probable Maximum Flood.

The Probable Maximum Precipitation (PMP) at the Town of Holland is 23.5 inches[2] for a 6-hour rainfall over a 10 square mile area. After proper adjustments for area size and for conformity of the generalized isohyetal patterns with the watershed shape[3], the effective 6-hour PMP becomes 18.02

*Numbers denote references listed at the end of the Section.

inches. This rainfall is distributed[4] so as to give a maximum 1-hour increment of 6.40 inches. For the land area, the application of losses at the rate of 0.2 inches per hour results in a total Rainfall Excess of 16.82 inches in 6 hours. The PMF hydrograph for the effective land area was generated on the basis of the computed rainfall excess and the ordinates of the Snyder 30-minute unit hydrograph. Runoff rates resulting from the PMP over the reservoir area were also generated on the basis of the rainfall distribution. The Test Flood hydrograph was developed by the addition of one-half of PMF hydrograph ordinates for the land area and corresponding runoff rates mentioned above. The resulting peak inflow is 12,710 cfs. Assuming that the reservoir would be at spillway crest and that the low level outlet would be inoperative at the beginning of the PMP occurrence, the Test Flood was routed through the estimated available discharge and storage capacities using a computer routing technique. This discharge capacity estimate was based on plans of the structure by others.[5] The storage capacity estimate was based on USGS topographic information.[6] The results of the routing indicate that the reservoir pool under the assumed Test Flood conditions would reach a maximum elevation of 689.06, a level at which flow over the estimated crest of the dam would be 1.06 feet deep. The total outflow corresponding to the maximum pool elevation would be 8994 cfs. As a part of this study it was determined that 22% of the PMF could be processed by the existing works without overtopping. Accordingly, the existing spillway capacity in conjunction with the available storage are termed inadequate from the hydrologic and hydraulic standpoint.

References

1/ "National Program of Inspection of Dams" Department of the Army, Office of the Chief of Engineers, Washington, D.C. 20314, May 1975.

2/ "Rainfall Frequency Atlas of the United States" USWB Technical Paper No. 40.

3/ Engineer Circular EC 1110-2-27, August 1, 1966.

4/ "Manual for Estimation of Probable Maximum Precipitation", World Meteorological Organization WMO-No. 332, 1973.

5/ Drawings Entitled: Proposed Dam Restoration, Hamilton Reservoir, Holland, Mass. by Tighe & Bond, Inc., Holyoke, Massachusetts, August , 1957.

6/ USGS Quad. Sheet Wales, Mass. - Conn., 1967.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

Visual observations did not indicate any serious structural problems with the embankment, spillway or outlets. The deficiencies described in Section 3 require attention; measures to improve these deficiencies are given in Section 7.

b. Design and Construction Data

No design computations or other data pertaining to the structural stability of the dam have been located.

c. Operating Records

Operating records are kept for the low level gate and are available at the Department of Public Works. There are no records or reports of any operational problems which would affect the stability of the dam.

d. Post-Construction Changes

The dam was built in about 1960 to replace a previous dam which had been destroyed in the 1955 floods. There are no records of any construction changes made to the dam. Minor repairs were made about 10 years ago to the spillway. Some of the concrete along the vertical construction joints had broken off and were patched.

e. Seismic Stability

The dam is located in Seismic Zone No. 2 and in accordance with recommended Phase I guidelines does not warrant seismic analyses.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Condition

Phase I investigation of Hamilton Reservoir Dam does not indicate conditions which would constitute an immediate hazard to human life or property. Based on engineering judgment and the performance of the embankment, the spillway and the low level outlet, the project is considered to be in good condition. The project, however, does have inadequacies and deficiencies which, if not remedied, have the potential for developing into hazardous conditions.

Based on the size and hazard potential, the Test Flood, in accordance with Corps of Engineers' guidelines is one half the Probable Maximum Flood. The Probable Maximum Precipitation over the Hamilton Reservoir drainage area, when adjusted, results in a total rainfall excess of 16.82 inches in six hours. The PMF hydrograph for the effective land area was generated on the basis of the computed rainfall excess and the ordinates of a modified 15 minute unit hydrograph. Runoff rates resulting from the PMP over the reservoir area were also generated on the basis of rainfall distribution. The Test Flood hydrograph was developed by summing one half the PMF hydrograph ordinates for the land area and the corresponding runoff rates. The resulting inflow is 12,710 cfs.

The adequacy of the spillway was tested by routing the flood through the reservoir using a computer routing technique. It was assumed that the reservoir level at the start of the flood was at spillway crest (El 683) and the low level outlet was inoperative. The Test Flood (1/2 PMF) causes the reservoir level to rise to El 689.06 or 1.06 feet above the top of the dam. The total outflow corresponding to the Test Flood maximum elevation would be 8,994 cfs.

Since the dam is expected to be overtopped by an inflow equal to 1/2 PMF, it is considered that the spillway is inadequate from a hydraulic and hydrologic standpoint. Furthermore, the anticipated overtopping, which has a computed duration of about 4 hours would probably cause a failure of the non-cohesive right abutment. The left abutment rubble cored earthfill could probably withstand the overtopping.

b. Adequacy of Information

The lack of in-depth engineering data did not allow for a definitive review. Therefore the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgment.

c. Urgency

The recommendations and remedial measures described in subsequent paragraphs should be undertaken by the owner within the next 12 to 24 months after receipt of this Phase I Inspection Report.

d. Necessity for Additional Investigations

Additional investigations to assess the adequacy of the dam and appurtenant structures appear to be necessary and are enumerated in the following paragraph.

7.2 RECOMMENDATIONS

It is recommended that the owner within 12 months of receipt of this Phase I Inspection Report retain a competent consulting engineer to conduct detailed hydraulic studies to determine the measures necessary to improve discharge capacities.

7.3 REMEDIAL MEASURES

a. Alternatives

The results of the additional investigations recommended above may indicate alternatives which will be needed to provide discharge adequacy under flood conditions. These alternatives can only be determined after the completion and evaluation of the additional investigations.

b. Operating and Maintenance Procedures

It is recommended that the following measures be undertaken by the owner within 24 months after receipt of this Phase I Inspection Report.

1. Establish a formal program of operation and maintenance and initiate biennial inspections of the dam.

2. Provide round-the-clock surveillance during periods of unusually heavy precipitation.

3. Develop, with local officials, a formal system for warning downstream residents in case of emergency.

4. Remove all trees and young saplings from both slopes of the embankment and keep other vegetation in a close cut condition.

5. Remove debris and overhanging trees from downstream channel.

VISUAL INSPECTION CHECKLIST

APPENDIX A

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT HAMILTON RESERVOIR DAM

DATE 10-27-78
TIME 9.00 AM
WEATHER Sunny, 60°-70°F
W.S. ELEV. 681.75 U.S.

PARTY:

1. Harvey S Feldman
2. Jyotindra H Patel
3.
4.
5.
6.
7.
8.
9.
10.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	All project features	inspected by above party members.	
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECK LIST

PROJECT HAMILTON RESERVOIR DAM DATE 10-27-78

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

DAM EMBANKMENT

Crest Elevation (MSL) 688.0

Current Pool Elevation (MSL) 681.75

Maximum Impoundment to Date _____

Surface Cracks None observed

Pavement Condition No pavement on crest.

Movement or Settlement of Crest None observed

Lateral Movement None observed

Vertical Alignment Generally Good

Horizontal Alignment Generally Good

Condition at Abutment and at Concrete Structures Both abutments good; also good at concrete structures

Indications of Movement of Structural Items on Slopes None observed

Trespassing on Slopes None on both slopes

Sloughing or Erosion of Slopes or Abutments None observed

Rock Slope Protection - Riprap Failures None observed (see misc. comment.)

Unusual Movement or Cracking at or near Toes None observed

Unusual Embankment or Downstream Seepage None observed

Piping or Boils None observed

Foundation Drainage Features None

Toe Drains None

Instrumentation System None

Miscellaneous: 1) There are four ten foot tall evergreens and few small fruits plant which have been planted by the owner of the house adjacent to the embankment

2) The stone riprap is in sound condition with some tall grass growing through it

PERIODIC INSPECTION CHECK LIST

PROJECT HAMILTON RESERVOIR DAM DATE 10-27-78

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE

a. Approach Channel

Slope Conditions Generally in good condition

Bottom Conditions Reservoir full therefore it was impossible to observe the bottom condition

Rock Slides or Falls None

Log Boom None

Debris None

Condition of Concrete Lining None

Drains or Weep Holes None

b. Intake Structure Sluice Gate located upstream face of Gate House and submerged.

Condition of Concrete Reported in good condition

Stop Logs and Slots None

c Miscellaneous Reported that trash rack in good condition; and some leaves collected at rack

PERIODIC INSPECTION CHECK LIST

PROJECT HAMILTON RESERVOIR DAM DATE 10-27-78

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

OUTLET WORKS - CONTROL TOWER Control for sluice gate is located on the top of gate chamber. The control is protected by a chain link fence

a. Concrete and Structural

General Condition _____

Condition of Joints _____

Spalling _____

Visible Reinforcing _____

Rusting or Staining of Concrete _____

Any Seepage or Efflorescence _____

Joint Alignment _____

Unusual Seepage or Leaks in Gate Chamber _____

Cracks _____

Rusting or Corrosion of Steel _____

b. Mechanical and Electrical

Air Vents _____

Float Wells _____

Crane Hoist _____

Elevator _____

Hydraulic System —

Service Gates Sluice gate (See comments below) and manually operated

Emergency Gates —

Lightning Protection System —

Emergency Power System —

Wiring and Lighting System —

Miscellaneous. 1. The operating stand (control) is in good condition

2. It is reported that sluice gate is in operating condition.

PERIODIC INSPECTION CHECK LIST

PROJECT HAMILTON RESERVOIR DAM DATE 10-27-78

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL

There is no outlet structure and outlet channel is spillway channel. See comments on Spillway ... and Discharge channel

~~General Condition of Concrete~~ _____

Rust or Staining _____

Spalling _____

Erosion or Cavitation _____

Visible Reinforcing _____

Any Seepage or Efflorescence _____

Condition at Joints _____

Drain Holes _____

Channel _____

Loose Rock or Trees Overhanging Channel _____

Condition of Discharge Channel _____

PERIODIC INSPECTION CHECK LIST

PROJECT HAMILTON RESERVOIR DAM DATE 10-27-78

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS

a. Approach Channel None

General Condition _____

Loose Rock Overhanging Channel _____

Trees Overhanging Channel _____

Floor of Approach Channel _____

b. Weir and Training Walls

General Condition ~~of Concrete~~ Weir and training walls are in generally in good condition. - See also Misc. Comments

Rust or Staining No rust or staining on weir. Right downstream training wall shows minor rust at bottom

Spalling Little or no spalling on weir and training walls.

Any Visible Reinforcing None

Any Seepage or Efflorescence None

Drain Holes None at weir and left downstream training wall; Right downstream training wall drain holes are running.

c. Discharge Channel

General Condition Discharge channel in good condition.

Loose Rock Overhanging Channel None

Trees Overhanging Channel _____

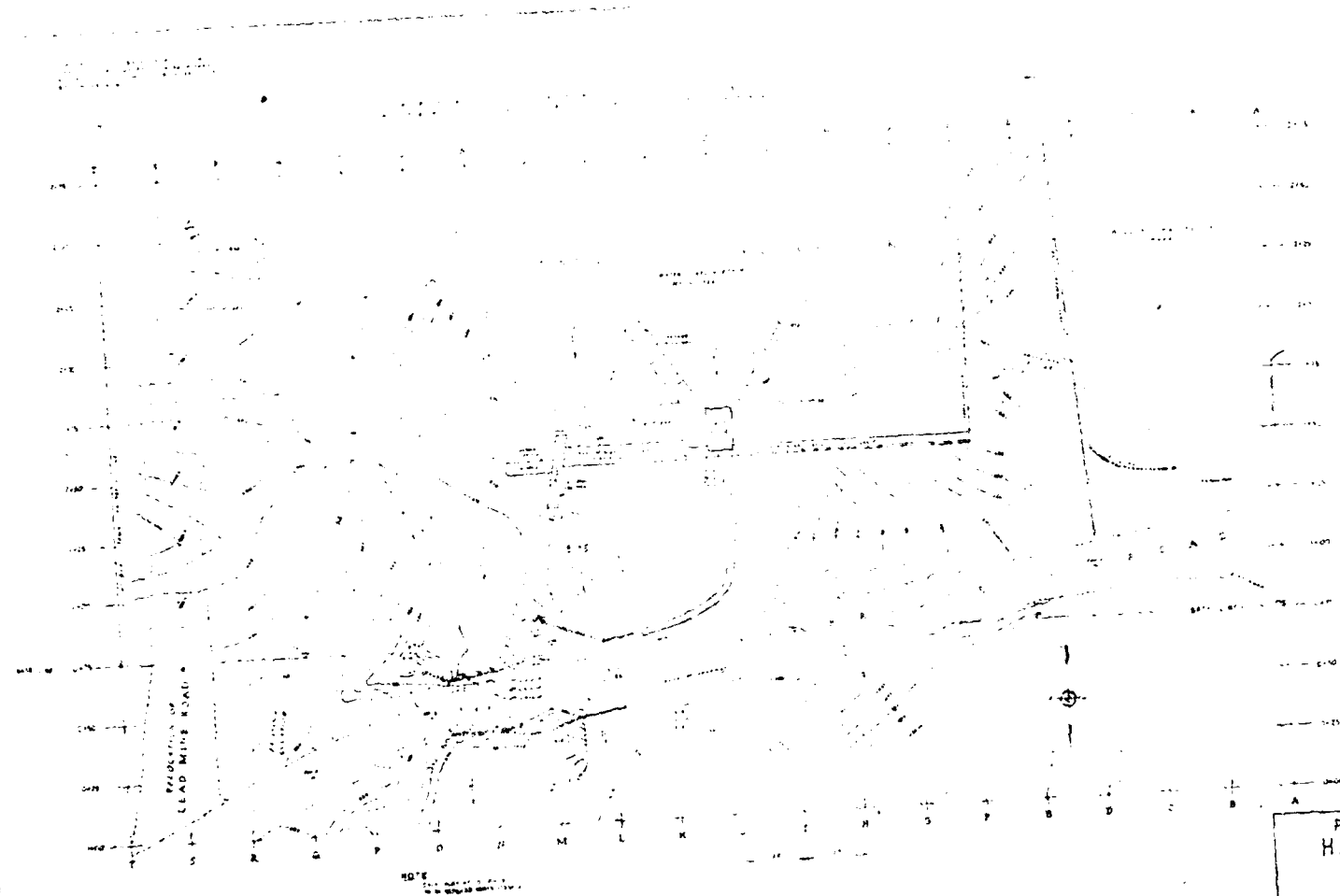
Floor of Channel Concrete, stone protected and natural bed.

Other Obstructions Roadway bridge and 2(three) Asphalt covered corrugated metal pipe; some large gravel and small boulders were observed on the apron.

Miscellaneous. Lower portion of left downstream training wall shows vegetation growing out of the joints.

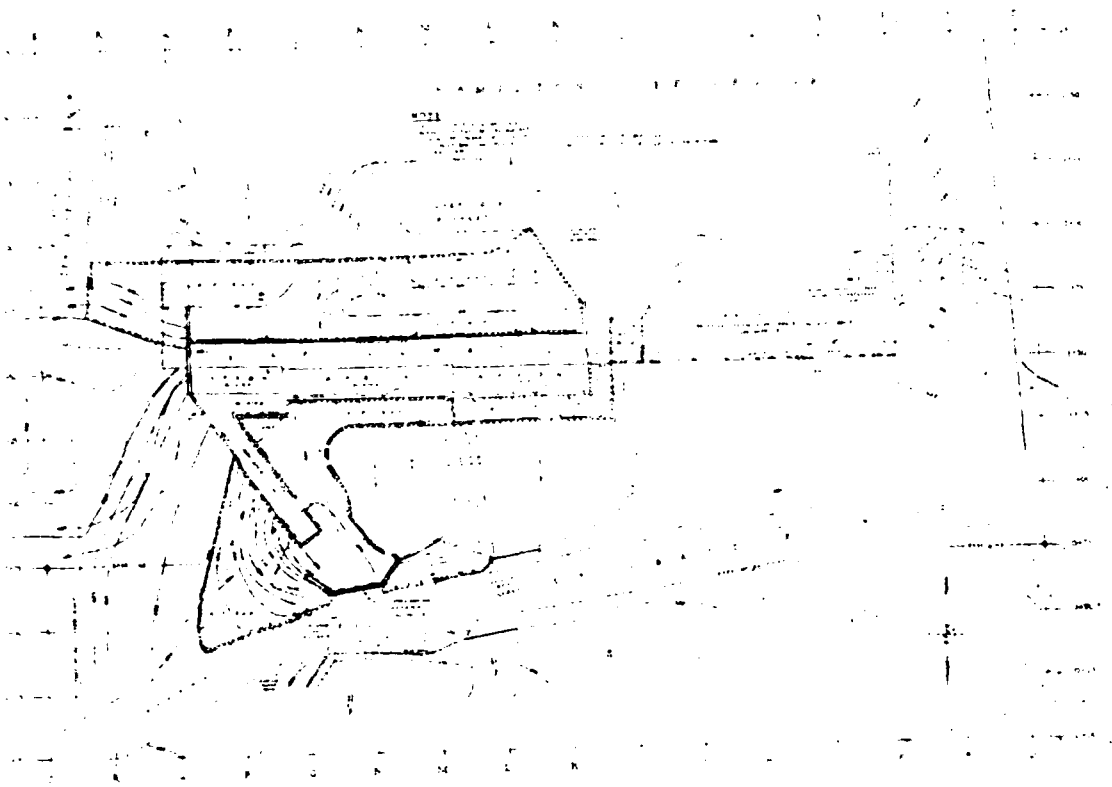
DRAWINGS AND INSPECTION REPORTS

APPENDIX B

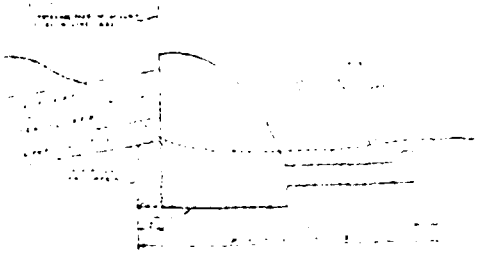


PLAN OF EXISTING STRUCTURES

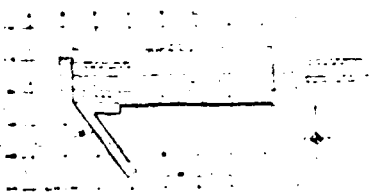
REPRODUCED AT GOVERNMENT EXPENSE



PLAN OF PROPOSED STRUCTURES

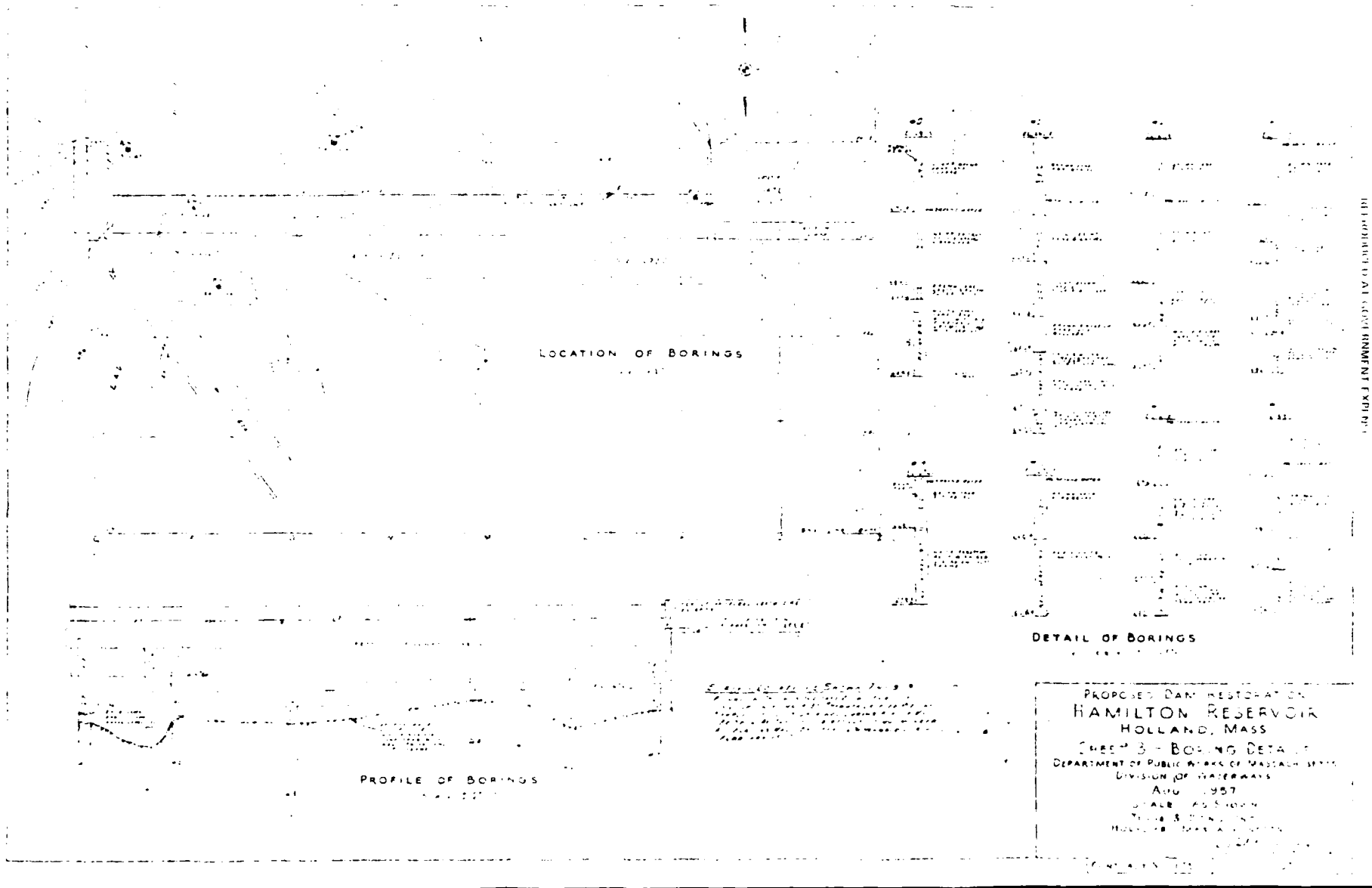


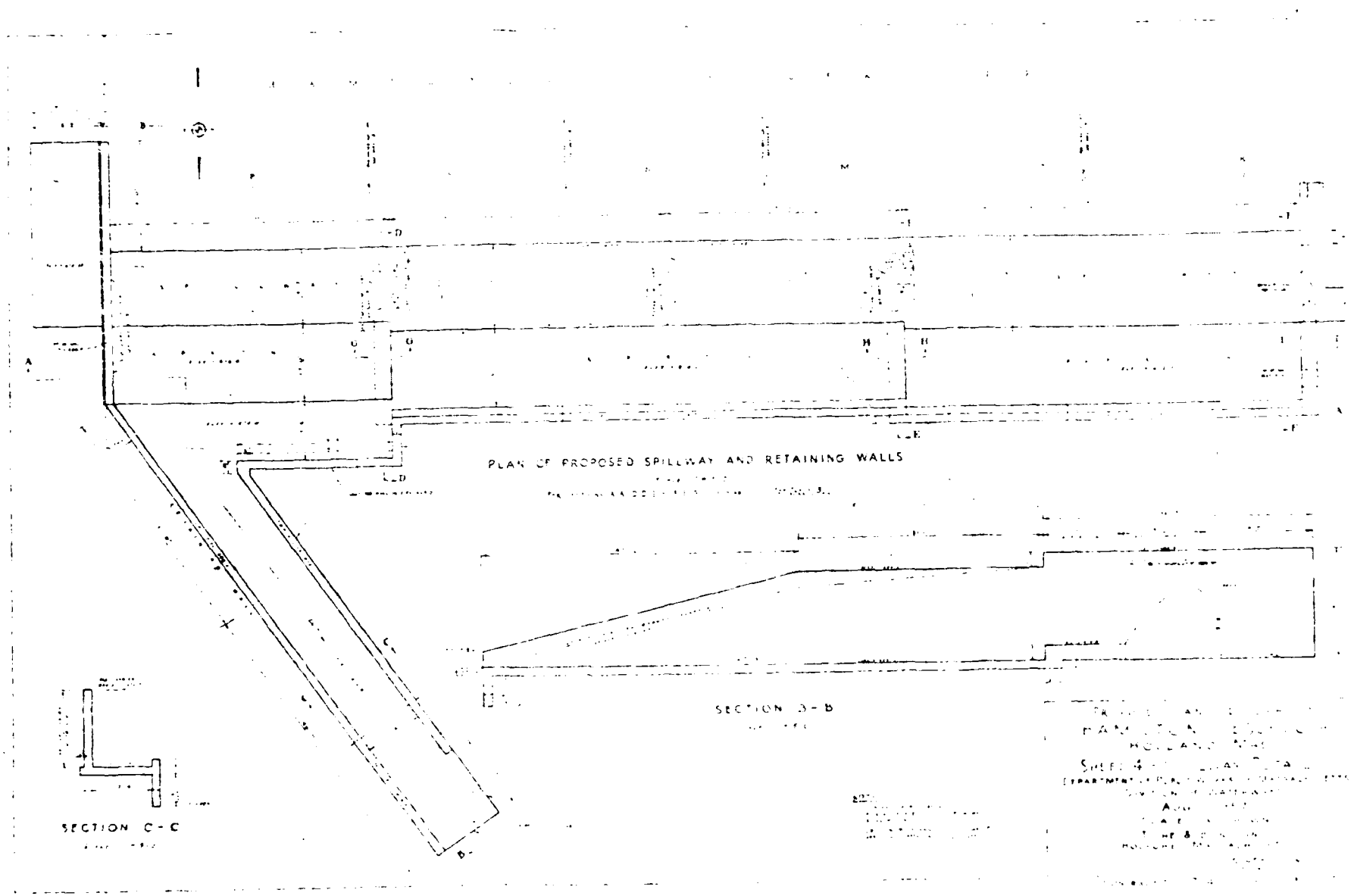
TYPICAL PAY LINES
EARTH EXCAVATION



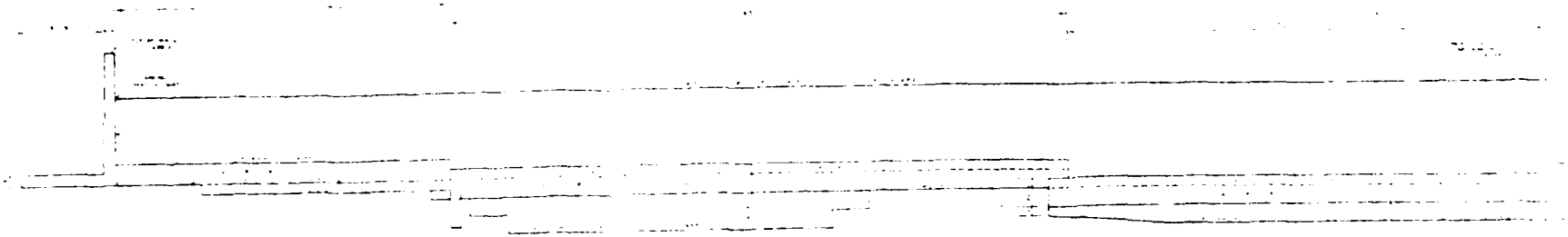
LOCATION PLAN
PROPOSED STRUCTURES

PROPOSED SAND RESTORATION
HAMILTON INLET
HOLLAND
SHEET
DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF WATERWAYS
AUGUST 1957
SCALE AS SHOWN
TIGHE & BOND
HOLYOKE MASSACHUSETTS

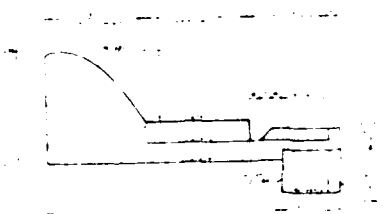

LOCATION OF BORINGS
PROFILE OF BORINGS
DETAIL OF BORINGS
PROPOSED DAM RESTORATION
HAMILTON RESERVOIR
HOLLAND, MASS
SHEET 3 - BORING DETAILS
DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF WATERWAYS
AUG 1957
SCALE AS SHOWN



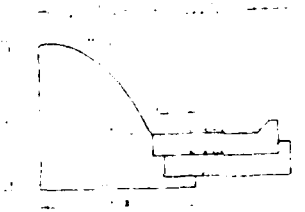
REPRODUCED AT GOVERNMENT EXPENSE



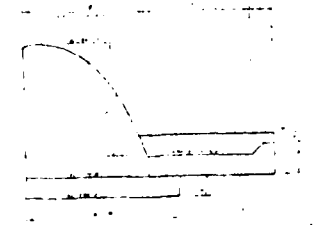
SECTION A-A OF PROPOSED SPILLWAY AND RETAINING WALLS



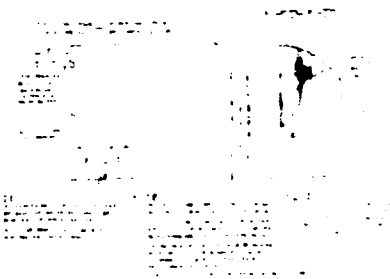
SECTION D-D



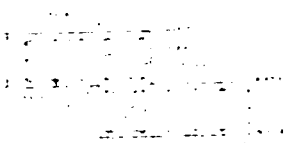
SECTION E-E



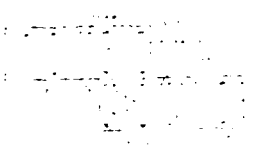
SECTION F-F



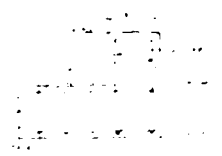
STANDARD EXPANSION JOINT



SECTION G-G

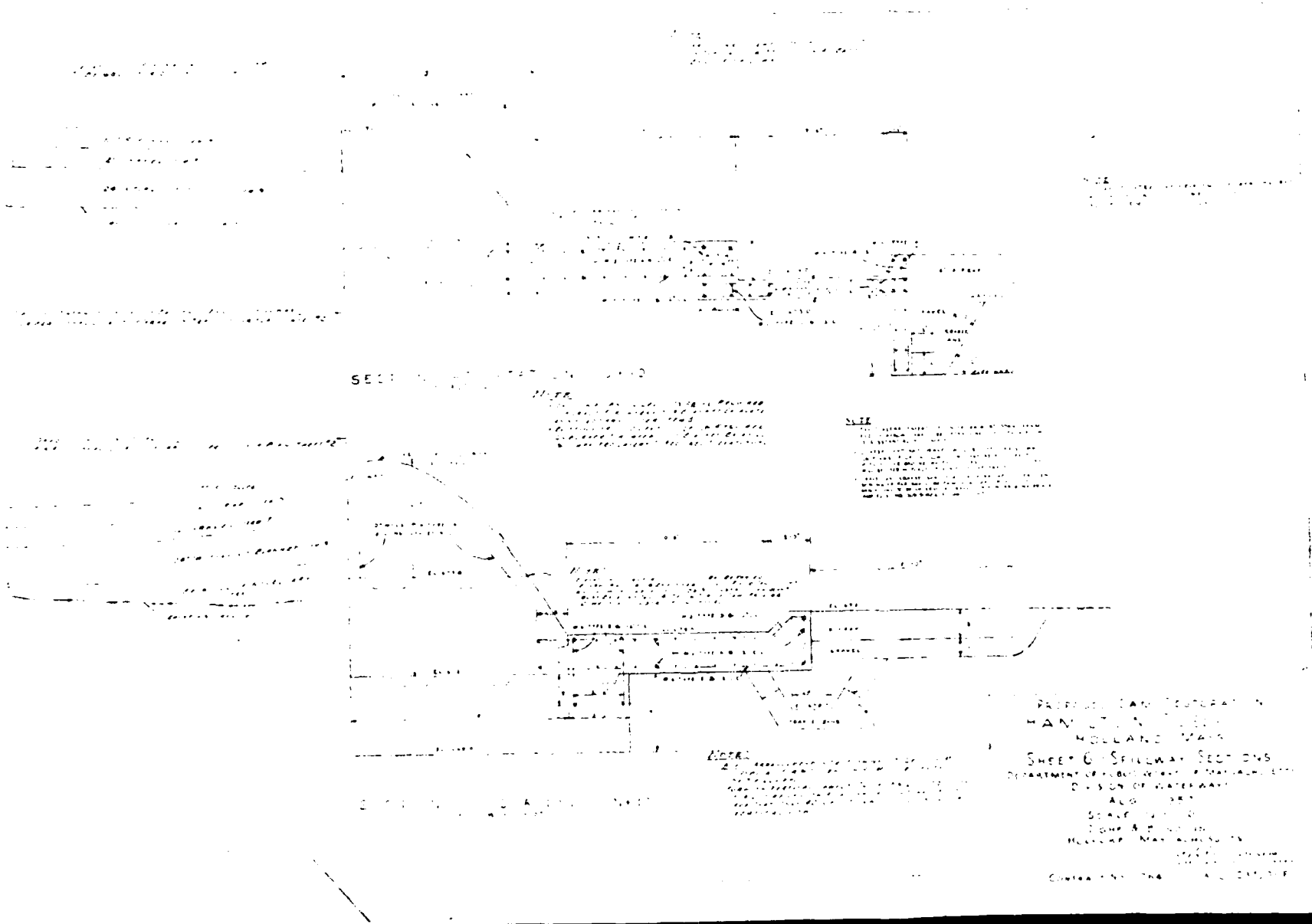


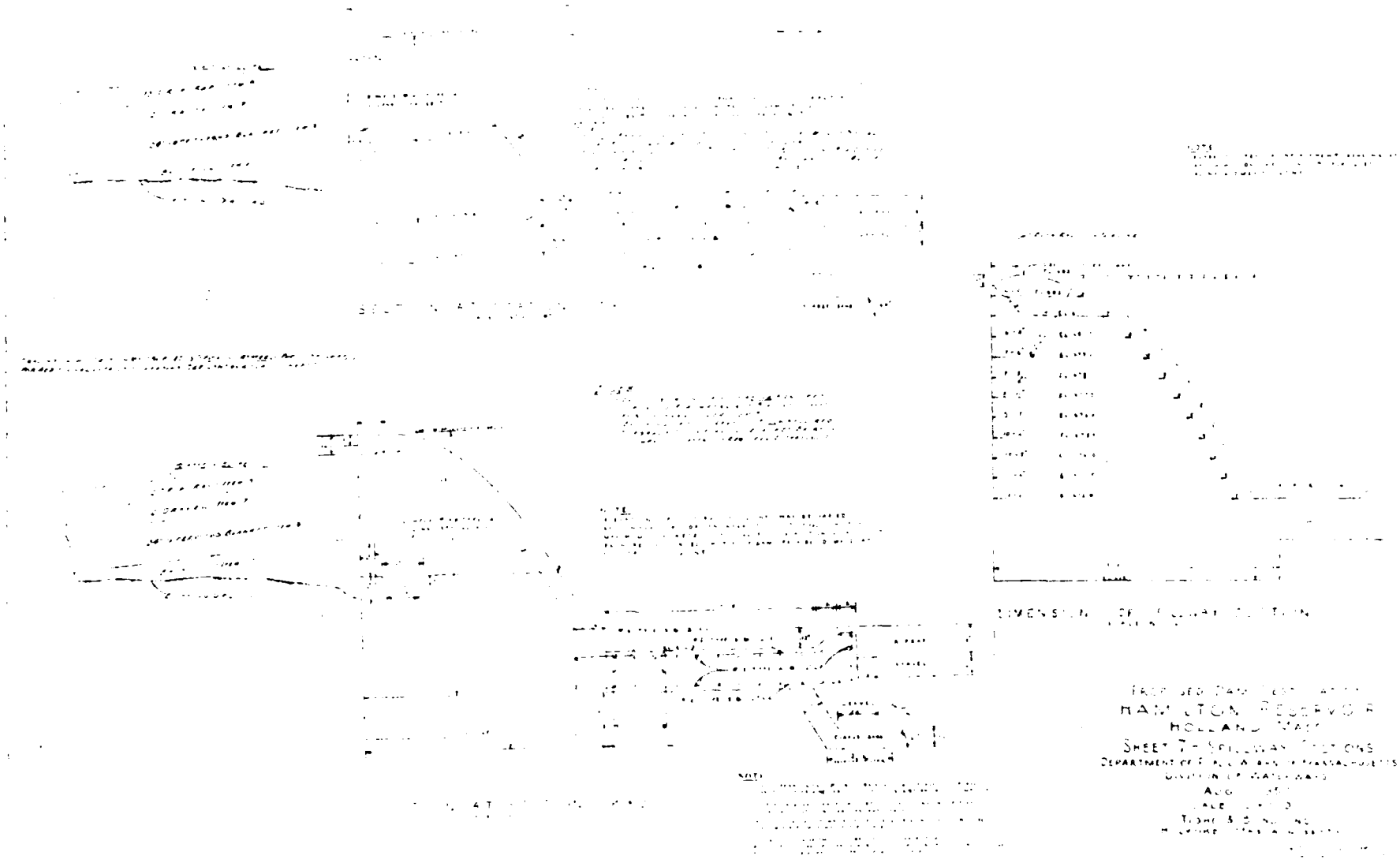
SECTION H-H

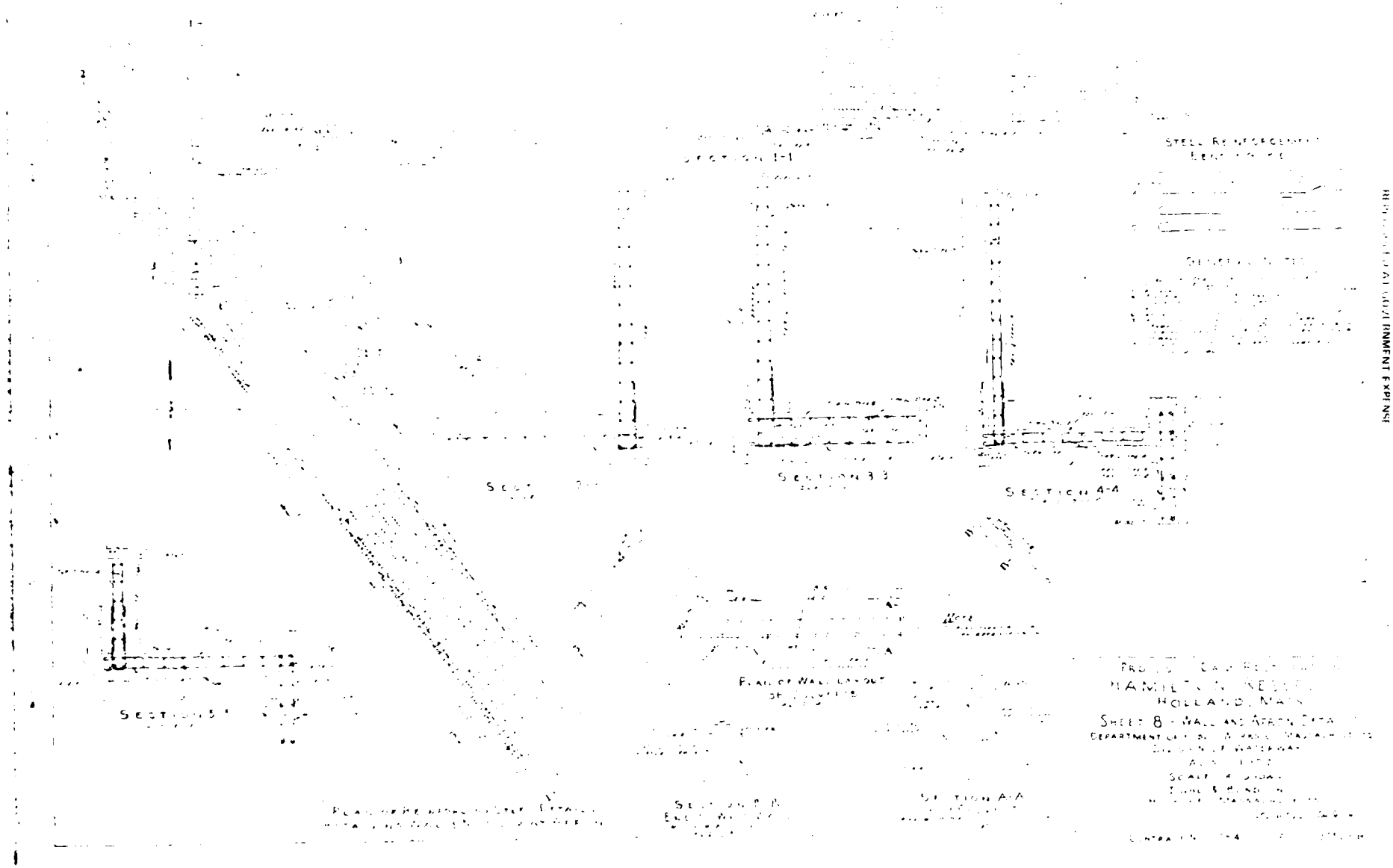


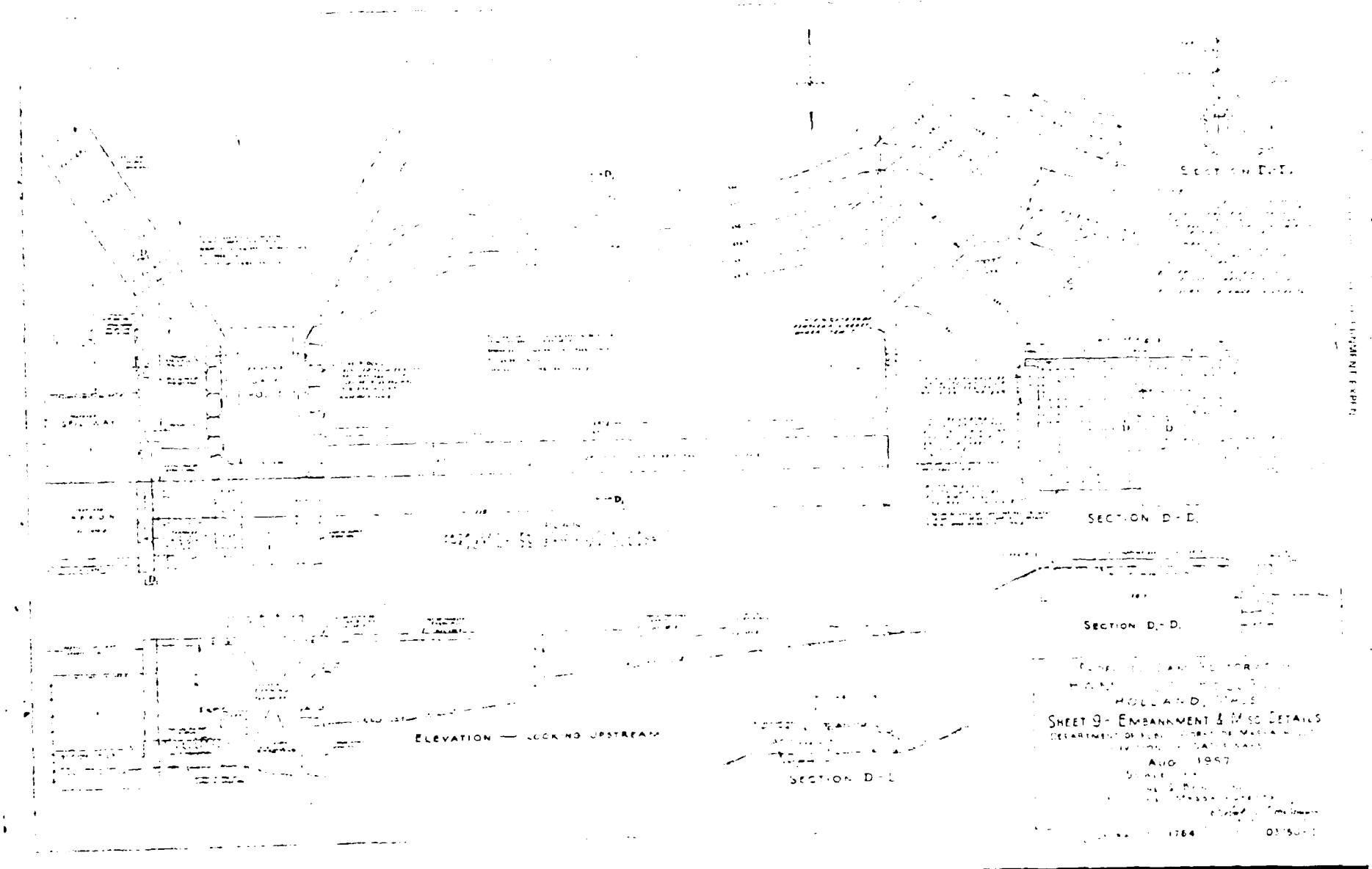
SECTION I-I

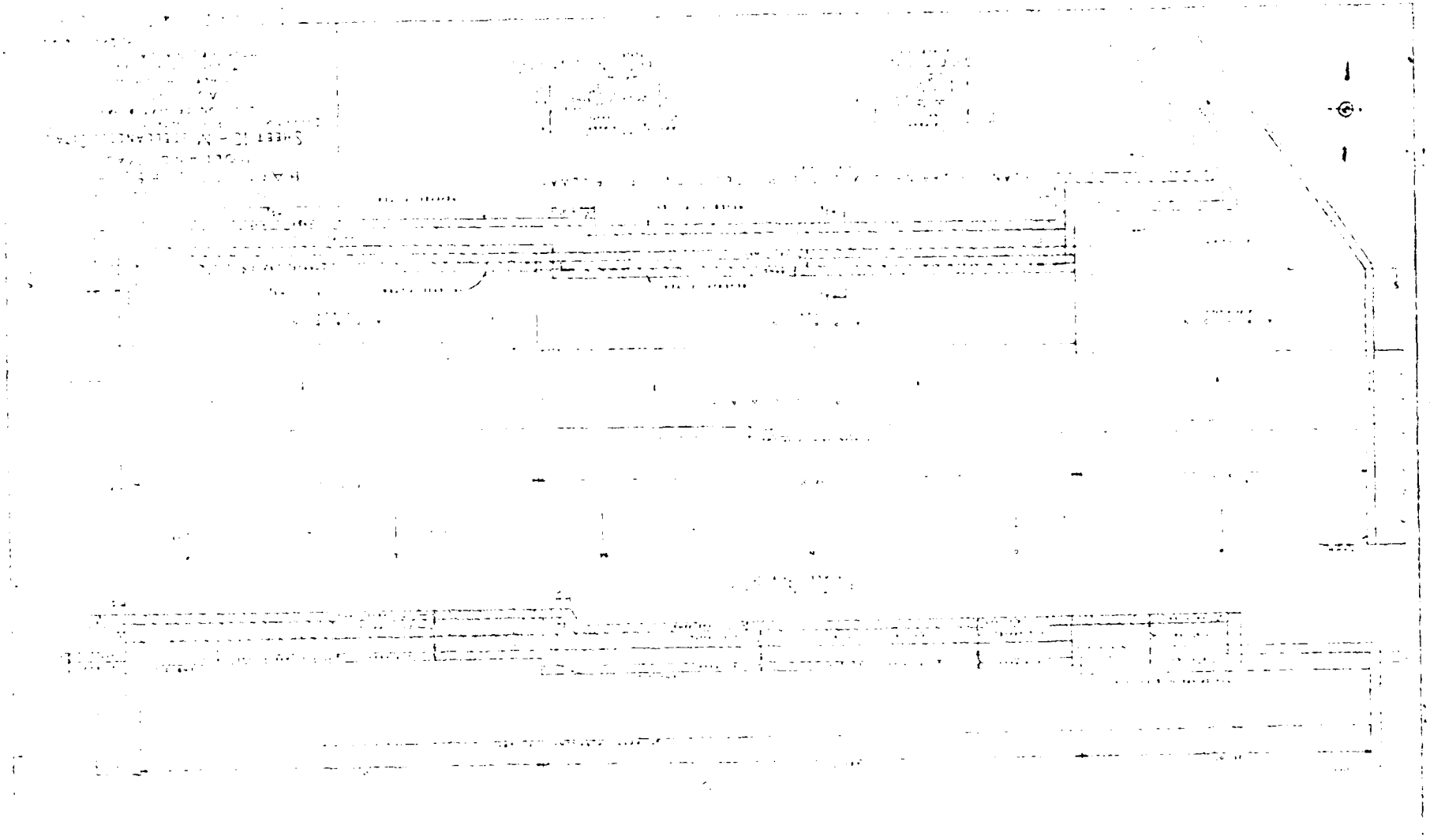
SHEET E - SPILLWAY DETAILS

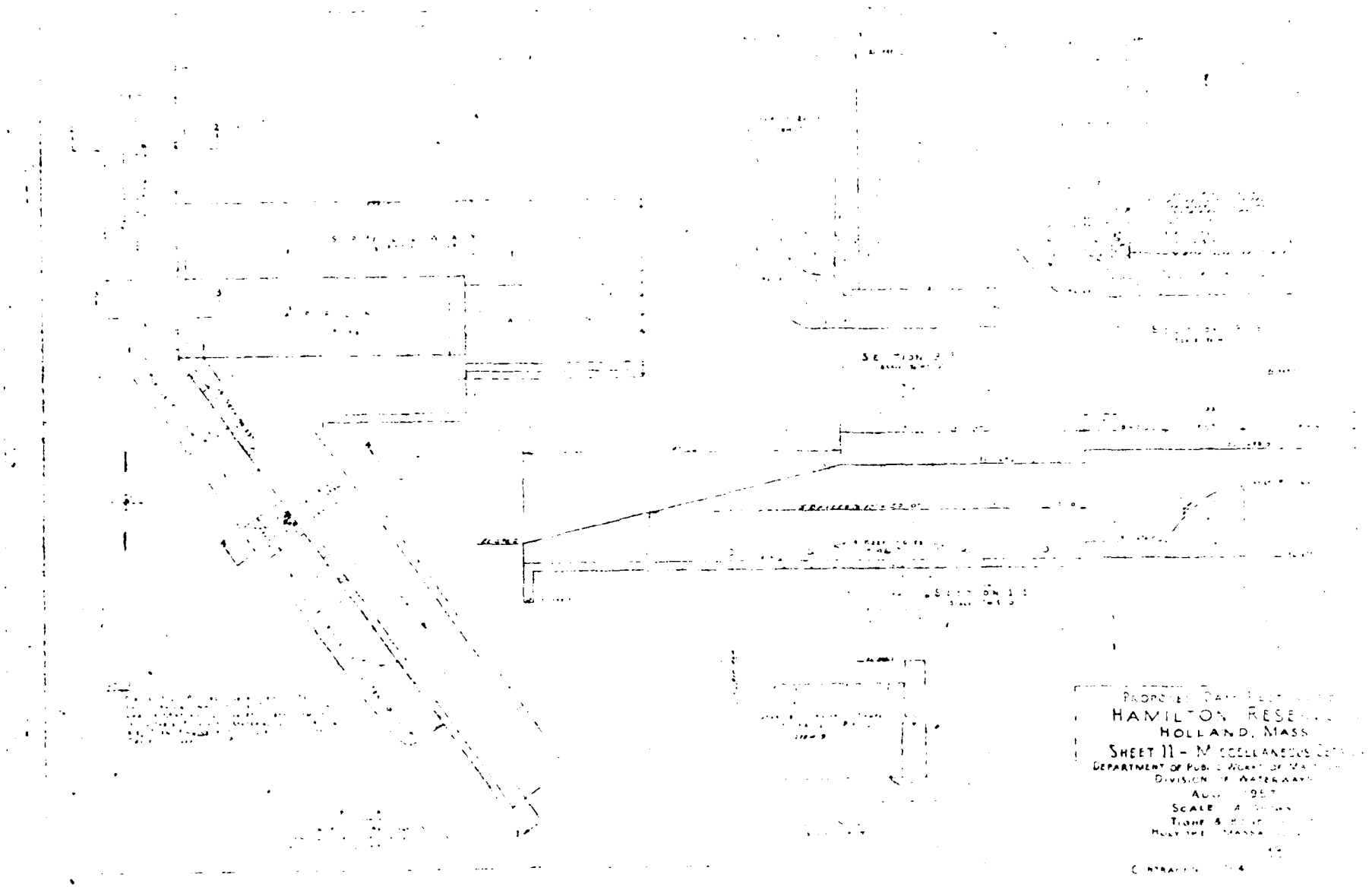





SECTION 1-1
SECTION 3-3
SECTION 4-4
SECTION 5-5
PLAN OF WALL LAYOUT
SECTION A-A
HOLLAND, MAN
SHEET 8 - WALL AND APRON DATA


SECTION D-D
SECTION D-D
ELEVATION — LOOKING UPSTREAM
SECTION D-D
HOLLAND, MASS
SHEET 9 - EMBANKMENT & MISC DETAILS
AUG 1957
1784





GOVERNMENT EXPENSE

Following drawings are available in records of owner, Town of Holland. These drawings are not included in this report.

Dwg. Dated: February, 1959 Contract No. 1942

Title	Reference No.
Sheet 1 - Plan	ACC 03889-A
Sheet 2 - Plan	ACC 03889-B
Sheet 3 - Gate House	ACC 03889-C
Sheet 4 - Gate House	ACC 03889-D
Sheet 5 - Gate House Reinforcing	ACC 03889-E
Sheet 6 - Gate House Reinforcing	ACC 03889-F
Sheet 7 - Miscellaneous Details	ACC 03889-G

12

TIGHE & BOND CONSULTING ENGINEERS

DAMS IN HAMPDEN COUNTY, MASSACHUSETTS

HOLLAND

1. Holland Rod & Gun Club - Upper Dam 3-7-125-1

   Holland Rod & Gun Club, Holland, Mass.

2. Holland Rod & Gun Club - Lower Dam 3-7-135-2

   Holland Rod & Gun Club, Holland, Mass.

3. Hamilton Reservoir Dam 3-7-135-3

   Town of Holland, Mass.

The last routine inspections of all dams located in the Town of Holland were conducted in July of 1970. A letter-report on the conditions noted at each of the dams in Holland was submitted to the Commissioners of Hampden County on July 23, 1970.

Of the three dams listed, all three were in need of certain maintenance and repair work.

A copy of my report to the Commissioners of Hampden County is attached hereto for your information. Letters outlining the recommended maintenance and repair work were sent to the dam owners by the Commissioners of Hampden County.

An examination of the report of July 29, 1970 shows two additional dams that are normally inspected whenever I have been inspecting the other three dams in Holland. The first, the Domaingue Dam, is checked since it is on a stream having more than a square mile of drainage area and, though the dam formed is negligible in size, I have periodically made a notation of conditions at the dam.

Upstream on Stevens Brook, there is an old dam that has been breached for many years. Periodically, I inspect the old dam to be certain that the breach is open and can pass flood flows safely.

George H. McDonnell
County Hydraulic Engineer
Hampden County

H. McDONNELL
W. SHERIDAN
WARD J. BAYON

TIGHE & BOND CONSULTING ENGINEERS

CIVIL, SANITARY AND ELECTRICAL ENGINEERING
INVESTIGATIONS, REPORTS, PLANS AND SPECIFICATIONS
SUPERVISION OF CONSTRUCTION AND OPERATION

BOWERS AND PEQUOT STREETS
HOLYOKE, MASSACHUSETTS
TEL. JEFFERSON 3-3991

CD Holland
July 23, 1970

The Honorable the Board of County Commissioners
52 State Street
Springfield, Massachusetts

Gentlemen:

Inspections have been made of all dams located in the Town of Holland. Each dam has been inspected at least once during the year 1970. The following report shows the condition of each dam at the time of inspection.

A. Holland Rod & Gun Club - Upper Dam

The embankment is partially breached in the vicinity of the old masonry spillway. The breach is wide enough but it should be deepened by the removal of stones and earth until the breach elevation approaches that of the bottom of the pond.

Stones lying in the stream bed between the dam and the roadway culvert should be removed. If the stones are allowed to remain in their present location they may be washed into the culvert opening and plug the culvert. Should this occur, storm flow runoff could result in a washout of the roadway adjacent to and immediately below the dam.

No water is ponded by the dam at time of normal stream flow. However, in time of high rates of runoff, water is ponded up to the elevation of the bottom of the breach thru the dam embankment. Normally, flow of the brook seeps thru the rock fill of the embankment at a rate approximately equal to the normal stream flow.

The embankment is becoming brush covered and it is apparent that the dam and pond have been abandoned by the Holland Rod & Gun Club.

If the owner will deepen the breach as now existing thru the dam at the location of the old spillway, the quantity of water that can be stored during time of high rates of runoff will be reduced greatly. Also, by lowering the elevation of the breach, the breach itself will become more stable and there will be less chance of boulders being washed downstream towards the roadway culvert.

B. Holland Rod & Gun Club - Lower Dam

This dam receives very little maintenance and, as a result, is becoming dilapidated. Brush and small tree growth occurring on the top of the dam embankment has become so thick, on that portion of the embankment to the right of the spillway, that a proper inspection of the dam could not be made. All brush, weed and small tree growth on the top of the dam embankment and at the toe of the dam must be cut down if the dam is to remain in operation. This type of growth should be cut down annually, its regrowth discouraged and a good growth of turf developed on the top of the dam embankment.

The upstream concrete wall extending the length of the dam needs patching just to the right of the spillway.

Water level in storage on the day of inspection was at the crest of the spillway. There were no stoplogs or flashboards on the spillway crest.

Seepage was observed again under the dam and the rate of seepage is approximately equal to the dry weather rate of stream flow in the brook. The greatest amount of seepage was noted at the toe of the downstream stone masonry wall just to the left of the spillway. Wet areas were observed all along the toe area of the dam. None of these areas indicate a flow of water of sufficient quantity to be dangerous. No soil movement was noted.

The stone wall forming the downstream face of the embankment is rough but satisfactory.

In the opinion of the undersigned, the dam must be given more attention and be maintained in a better manner. It is recommended that the owner be advised to do the maintenance work as outlined in my report.

C. Hamilton Reservoir Dam

The masonry of the right abutment and the right abutment wall was noted to be in satisfactory condition. One construction joint shows a minor amount of movement but this is of no concern whatsoever. Small tree growth is occurring adjacent to the concrete masonry wall on the abutment fill and this growth should be cut down and re-growth discouraged.

The stone filled and paved surface of the right abutment area should be cleared of all brush and small tree growth.

The overflow dam itself was in good condition. Masonry was satisfactory and there was little evidence of any erosion. Water level in storage in Hamilton Reservoir was at the crest of the spillway. There were no flashboards on the crest. Construction joints of the concrete spillway were o.k.

The toe area construction including channels, concrete construction and riprap were all noted to be o.k.

The twin ports at the gatehouse were operating normally. However, water was observed squirting out from under the seat of the drawdown gate. The gate should be re-positioned to eliminate this seat leakage. If allowed to continue week after week and month after month, it is possible that the seat and the gate itself may become eroded to the point where it will not be watertight. Opening the gate an inch or two and then closing it again will probably eliminate the leakage now evident, provided scouring of the seat and the gate has not already occurred.

The crack in the concrete of the gate structure is still the same as previously reported. There is no evidence of further enlargement of the crack. The crack is dry and approximately 3" deep at its deepest point.

The earth embankment at the left side of the gate structure was in good condition. The toe of the embankment was dry and the surface cover of turf was satisfactory.

It is recommended that the owner of the dam, the Town of Holland, do the following maintenance work as soon as possible.

A. Clear all brush and tree growth from the right abutment area and from the stone paved area to the right of and below the dam.

B. Re-position the drawdown gate in the gate structure to prevent squirting of water under the gate as now takes place.

C. Dig out loose masonry in the vertical crack on the outside of the gate structure and repair the crack with proper cement grout.

D. Domaingue Dam

This small structure, constructed for aesthetic purposes and to provide the owner a shallow wading pool, is in satisfactory condition. Though technically the small dam at the outlet end of the wading pool, and the small diversion dam located upstream, could be classified as dams under the provisions of the law because the brook has more than a square mile of drainage area, so little water is stored at shallow depths that loss of one or even both of these two dams would not release enough water downstream to do any damage to persons or property. In fact, an examination of the small pond behind the diversion dam shows that the volume of the pond has been nearly filled completely with soil washed in from upstream..

In the opinion of the undersigned, the two small dams and the related facilities of Mr. Domaingue are satisfactory.

E. Stevens Brook Dam

This old earth and stone dam has been breached for many years and no pond whatsoever is formed. The breach as observed at the time of the inspection this year was found to be very wide and to the full depth of the brook. The old pond area is heavily overgrown with brush and trees. Normally, I would recommend that this old dam site be dropped from the inspection list. However, since it is adjacent to the roadway leading into Holland from Wales and, since the site might be purchased by persons unfamiliar with the requirements for re-activating an old dam, the undersigned will continue to check the site from time to time when routine dam inspections are conducted in the Wales-Holland area.

Respectfully submitted,

George H. McDonnell

George H. McDonnell
County Hydraulic Engineer

GHM/amd

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: City/Town HOLLAND Dam No. 3-7-135-3

Name of Dam HOLLAND RESERVOIR DAM Inspected by TROIANO, MULCAHY, MARA

Date of Inspection AUG. 1, 1972

2. Owner/s: per: Assessors _____ Prev. Inspection _____

Reg. of Deeds _____ Pers. Contact _____

1. TOWN OF HOLLAND
Name St. & No. City/Town State Tel. No.

2. _____
Name St. & No. City/Town State Tel. No.

3. _____
Name St. & No. City/Town State Tel. No.

3. Caretaker (if any) e.g. superintendant, plant manager, appointed by absentee owner, appointed by multi owners.

Name: St. & No.

City/Town: State: Tel. No.

4. No. of Pictures taken 1

5. Degree of Hazard: (if dam should fail completely)*

1. Minor ~~✓~~ 2. Moderate _____

3. Severe ✓ 4. Disastrous _____

*This rating may change as land use changes (future development)

6. Outlet Control: Automatic _____ Manual 3'x5' SCREW GATE

Operative ✓ Yes; _____ No.

Comments: RODNEY HUNT SCREW GATE

7. Upstream Face of Dam: Condition:

1. Good ✓ 2. Minor Repairs _____

3. Major Repairs 4. Urgent Repairs _____

Comments:
CONCRETE DAM IN NEARLY NEW CONDITION

DAM NO. 3-7-135-3

8. Downstream Face of Dam:

Condition: 1. Good ✓ 2. Minor Repairs _____

3. Major Repairs _____ 4. Urgent Repairs _____

Comments:

9. Emergency Spillway:

Condition: 1. Good ✓ 2. Minor Repairs _____

3. Major Repairs _____ 4. Urgent Repairs _____

Comments:

10. Water Level at time of inspection: .2 ft. above ✓ below _____

top of dam F principal spillway ✓

other _____

11. Summary of Deficiencies Noted:

Growth (Trees and Brush) on Embankment SOME

Animal Burrows and Washouts NONE

Damage to slopes or top of dam NONE

Cracked or Damaged Masonry NONE

Evidence of Seepage NONE

Evidence of Piping NONE

Erosion NONE

Leaks NONE

Trash and/or debis impeding flow NONE

Clogged or blocked spillway PARTIALLY

Other

DAM # 3-7-135-3

2. REMARKS AND RECOMMENDATIONS: (FULLY EXPLAIN)

THE MASONRY OF THE RIGHT ABUTMENT AND THE RIGHT ABUTMENT WALL WAS NOTED TO BE IN SATISFACTORY CONDITION, ONE CONSTRUCTION JOINT SHOWS A MINOR AMOUNT OF MOVEMENT BUT THIS IS OF NO CONCERN WHATSOEVER. SMALL TREE GROWTH IS OCCURRING ADJACENT TO THE CONCRETE MASONRY WALL ON THE ABUTMENT FILL AND THIS GROWTH SHOULD BE CUT DOWN AND REGROWTH DISCOURAGED.

THE STONE FILLED AND PAVED SURFACE OF THE RIGHT ABUTMENT AREA SHOULD BE CLEARED OF ALL BRUSH AND SMALL TREE GROWTH.

THE OVERFLOW DAM ITSELF WAS IN GOOD CONDITION, MASONRY WAS SATISFACTORY AND THERE WAS LITTLE EVIDENCE OF ANY EROSION. WATER LEVEL IN STORAGE IN HAMILTON RESERVOIR WAS AT THE CREST OF THE SPILLWAY, THERE WERE NO FLASHBOARDS ON THE CREST. CONSTRUCTION JOINTS OF THE CONCRETE SPILLWAY WERE O.K.

THE TOE MASON CONSTRUCTION INCLUDING CHANNELS, CONCRETE CONSTUCTION AND RIP RAP WERE ALL NOTED TO BE O.K.

THE TWIN GATES AT THE CATEHOUSE WERE OPERATING NORMALLY THERE WERE NO LEAKS AT THE GATE, THE CRACK HAS BEEN REFILLED SINCE LAST INSPECTION.

THE EARTH EMBANKMENT AT THE LEFT SIDE OF THE GATE STRUCTURE WAS IN GOOD CONDITION. THE TOP OF THE EMBANKMENT WAS DRY AND THE SURFACE COVER OF TURF WAS SATISFACTORY.

SPILLWAY ON RIGHT SIDE HAS BEEN PARTIALLY BLOCKED WITH STONE TO DIVERT THE WATER OUT TO THE MAIN COURSE.

THE 3-30" DIAMETER PIPE UNDER THE ROAD, WHICH ARE PART OF THE RIGHT EMERGENCY SPILLWAY HAVE BEEN PARTIALLY BLOCKED WITH STONE.

APPROX 100'± DOWNSTREAM A HOUSE IS BEING BUILT W/ ITS FOUNDATION AS PART OF THE BANKING OF THE EMERGENCY WATER COURSE. THE FILL BEING PLACED AROUND THE HOUSE IS FALLING INTO THE WATER COURSE.

THIS TOWN SHOULD TAKE STEPS TO CLEAR OUT THESE STONE DAMS AND INFORM THE OWNER TO STOP DUMPING FILL INTO THIS WATER COURSE.

DESCRIPTION OF DAM

DISTRICT 3

Submitted by TROMBLY MULCAHY & MARKT Dam No. 3-7-135-3

Date AUG. 1, 1972 City/Town HOLLAND

Name of Dam HAMILTON RESERVOIR DAM

1. Location: Topo Sheet No. 18c

   Provide 8½" x 11" in clear copy of topo map with location of Dam clearly indicated.

2. Year built: 1956 Year/s of subsequent repairs _____

3. Purpose of Dam: Water Supply _____ Recreational V

   Irrigation _____ Other _____

4. Drainage Area: _____ sq. mi. _____ acrea

5. Normal Ponding Area: _____ acres; Ave. depth _____

   Impoundment: _____ gals; _____ acre ft.

6. No. and type of dwellings located adjacent to pond or reservoir

   1000+ i.e. summer homes, etc. SUMMER HOMES

7. Dimensions of Dam: Length 175' Max. Height 10'

   Slopes: Upstream Face VERTICAL

   Downstream Face 1:1.5

   Width across top 4'

8. Classification of Dam by Material:

   Earth _____ Conc. Masonry V Stone Masonry _____

   Timber _____ Rockfill _____ Other _____

9. A. Description of present land usage downstream of dam:

   100 % rural; _____ % urban.

   B. Is there a storage area or flood plain downstream of dam which could accomodate the impoundment in the event of a complete dam failure? yes V no _____.

DAM NO. 3-7-135-3

10. Risk to life and property in event of complete failure.

No. of people 25 ±.

No. of homes 5.

No. of Businesses 1.

No. of industries NONE. Type BUILDING SUPPLY

No. of utilities NONE. Type _____

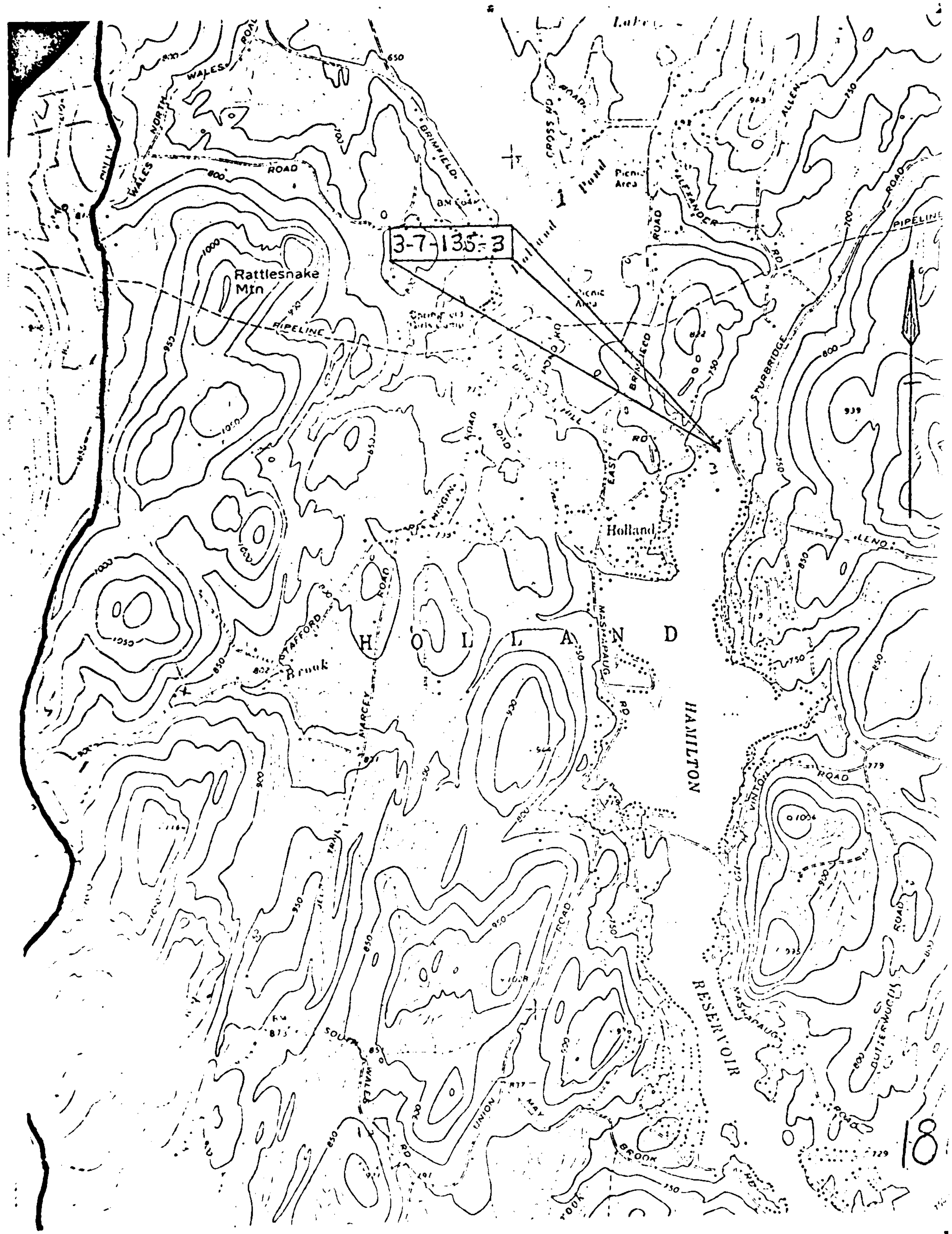
Railroads NONE.

Other dams NONE.

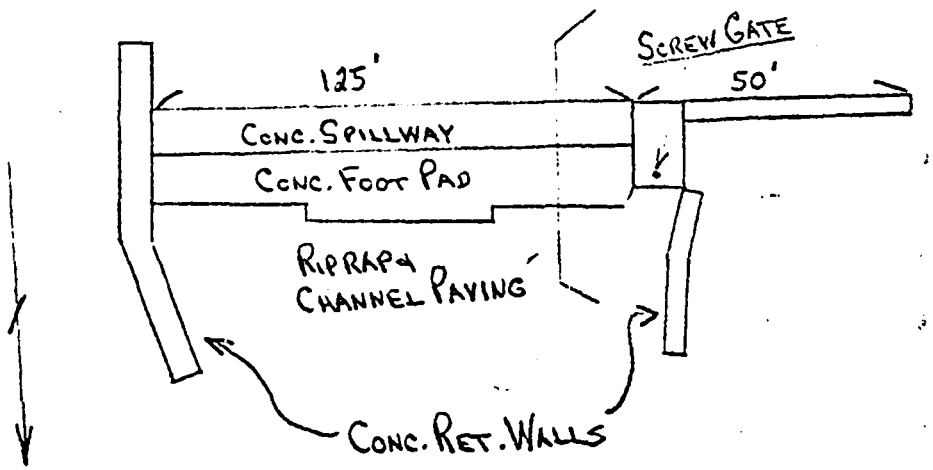
Other STURBRIDGE RD, EAST BRIMFIELD RD., & ALEXANDER RD

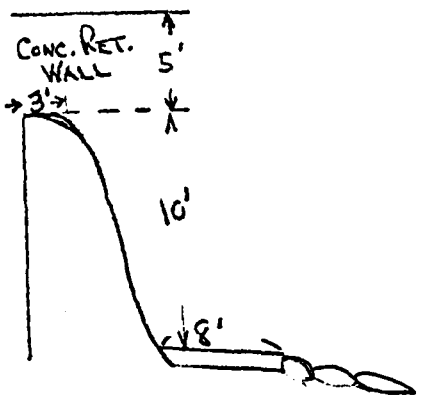
11. Attach Sketch of dam to this form showing section and plan on 8½" x 11" sheet.

12. HOW TO LOCATE: AT THE INTERSECTION OF STURBRIDGE RD. & LENO ROAD IN HOLLAND.


3-7-135-3
Rattlesnake
Mtn
PIPELINE
NORTH
WALES
ROAD
BRIMFIELD
CROSS RD
ALEXANDER
ALLEN
STURBRIDGE
Holland
H O L L A N D
STAFFORD
Brook
MARCEY
MASHAPAUG
HAMILTON
RESERVOIR
VINTON
ROAD
BUTTERWORTH
SOUTH
WALES
UNION
MAY
BROOK
18

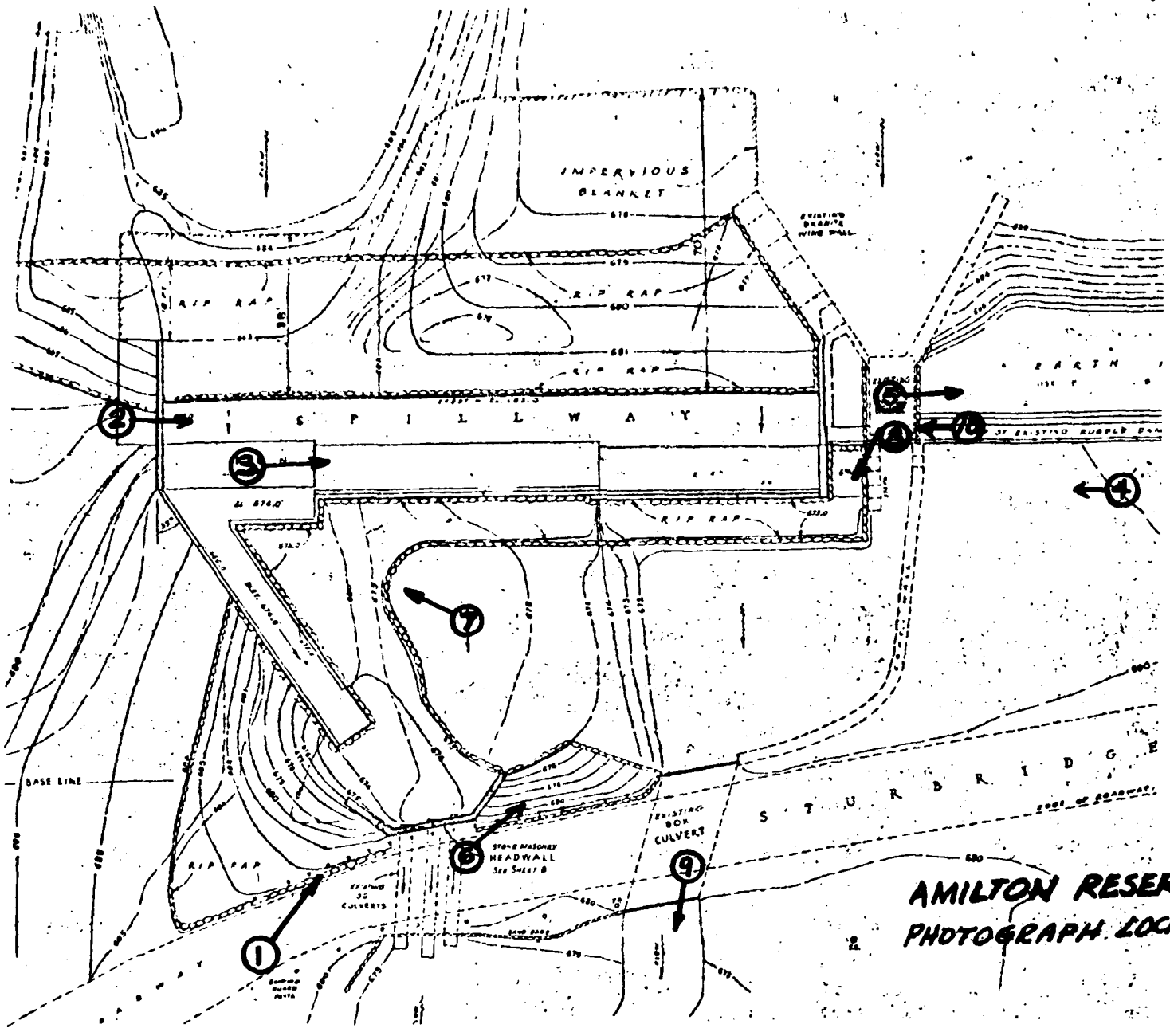
DAM No. 3-7-135-3
HOLLAND





PHOTOGRAPHS

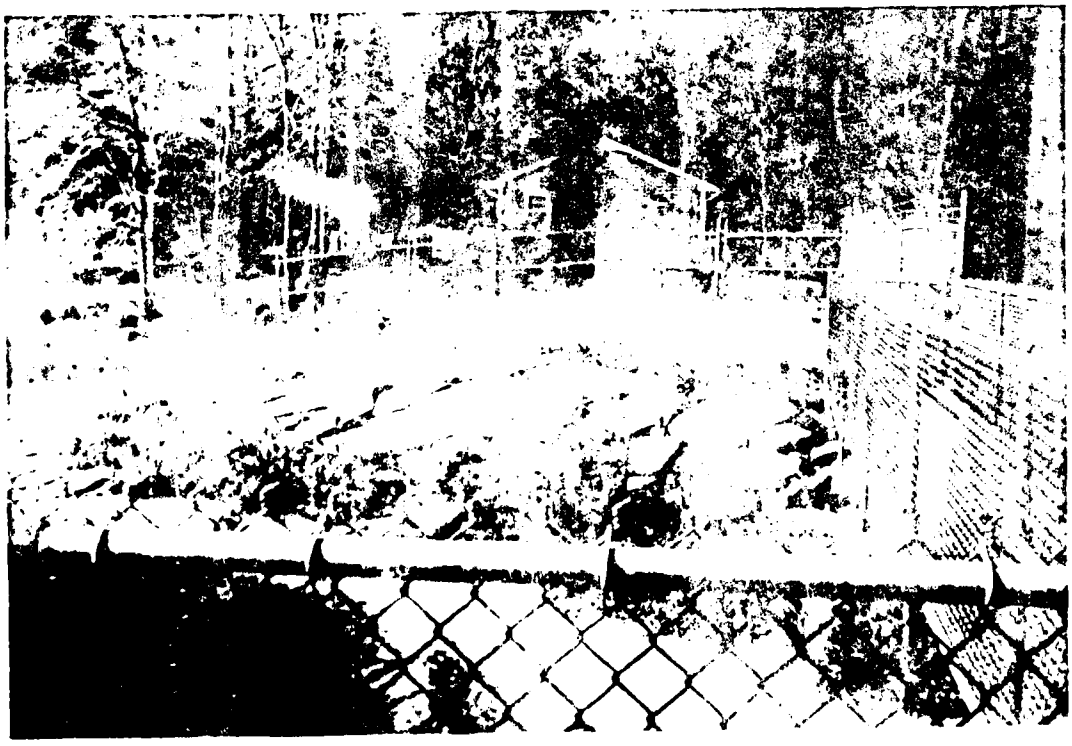
APPENDIX C



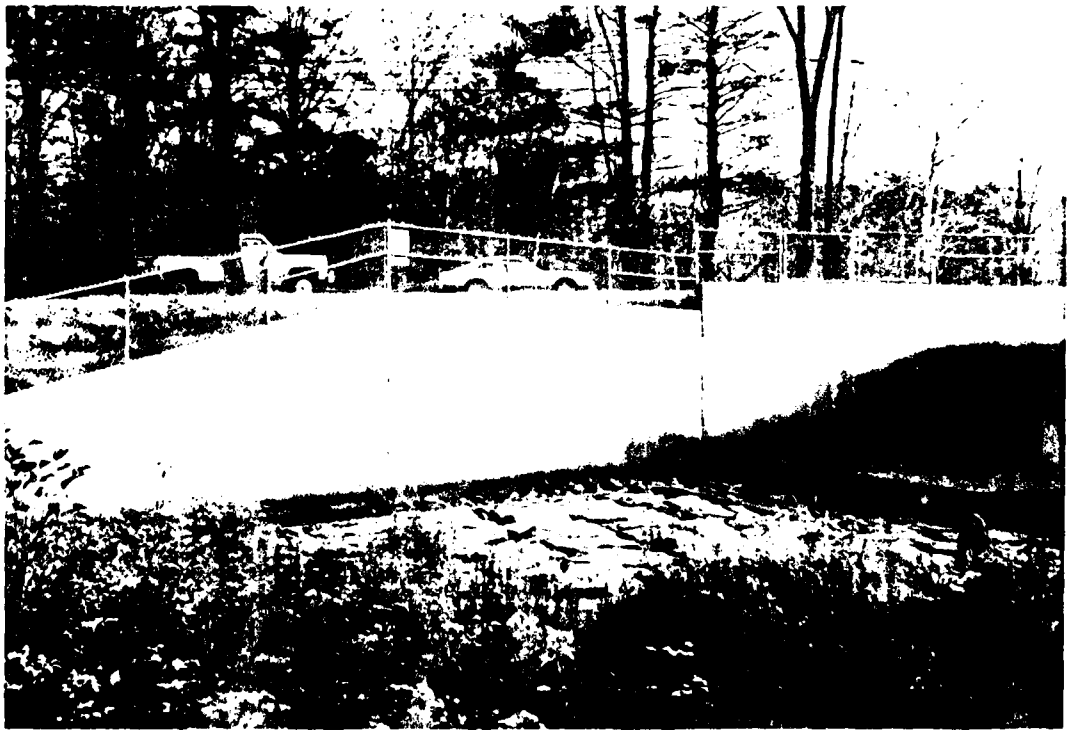
AMILTON RESERVOIR DAM
PHOTOGRAPH LOCATION PLAN

2. VIEW OF SPILLWAY CREST WITH LARGE [illegible]
LOOKING IN DOWNSTREAM DIRECTION

3. VIEW OF DOWNSTREAM FACE OF SPILLWAY
SHOWING APRON AND CONCRETE BLOCKS

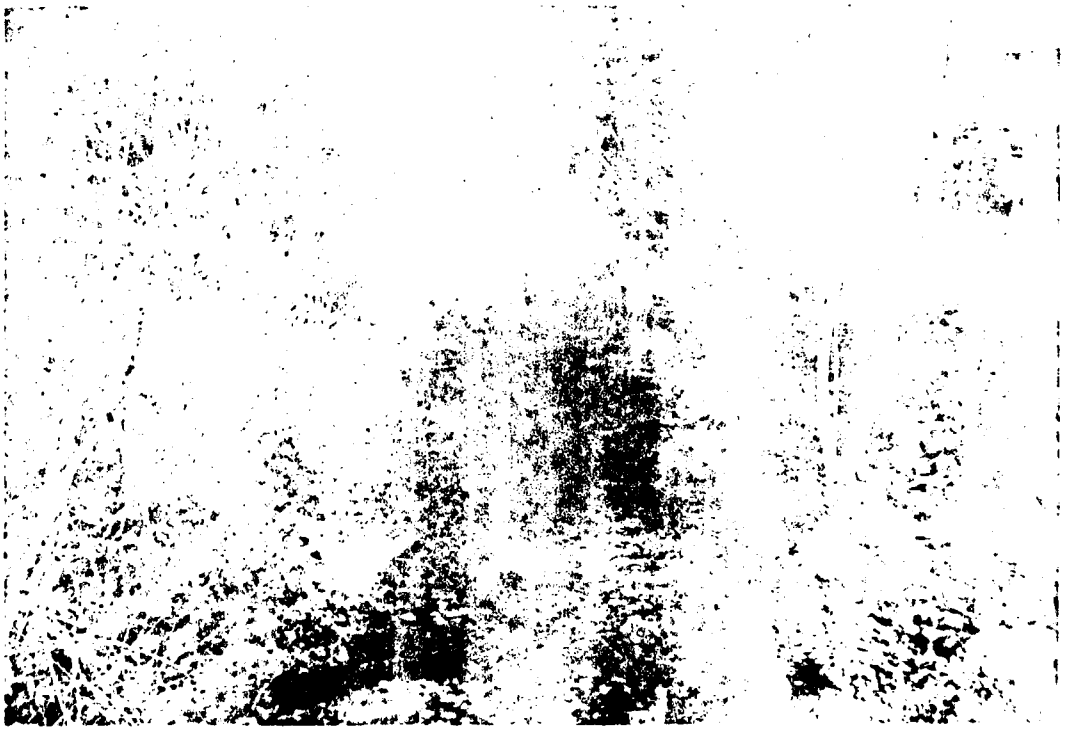


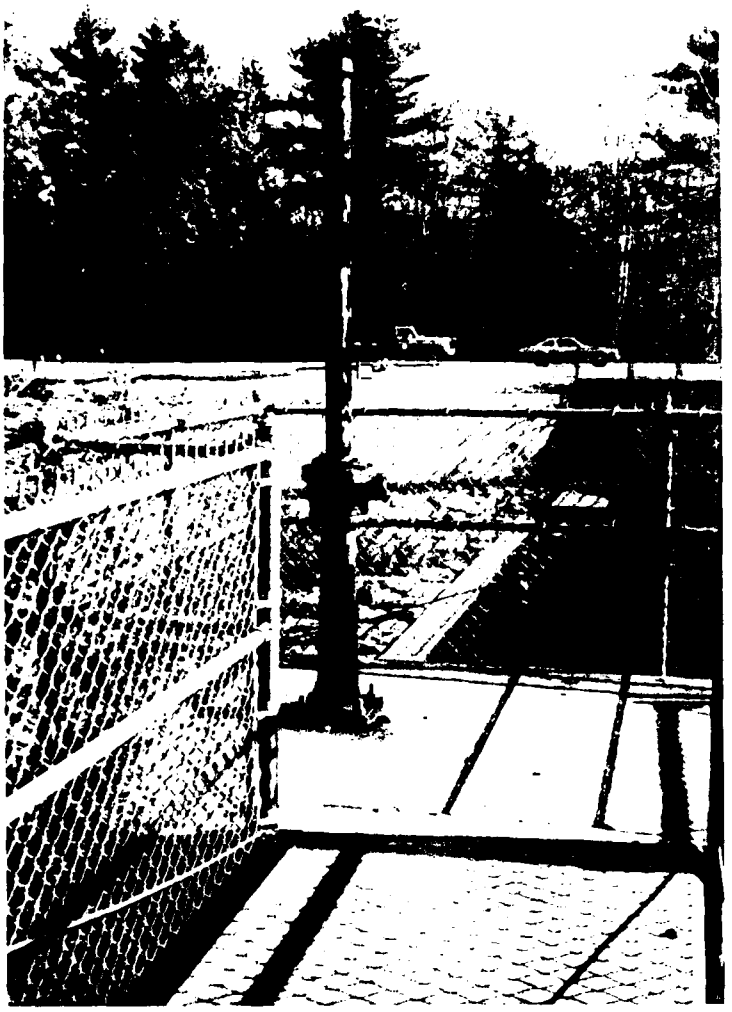
6. VIEW OF GATEHOUSE, DOWNSTREAM TRAINING WALL AND RIPRAP ON CHANNEL FLOOR.



7. VIEW OF DOWNSTREAM TRAINING WALL, SPILLWAY APRON AND RIPRAP ON CHANNEL FLOOR.

REPRODUCED AT GOVERNMENT EXPENSE



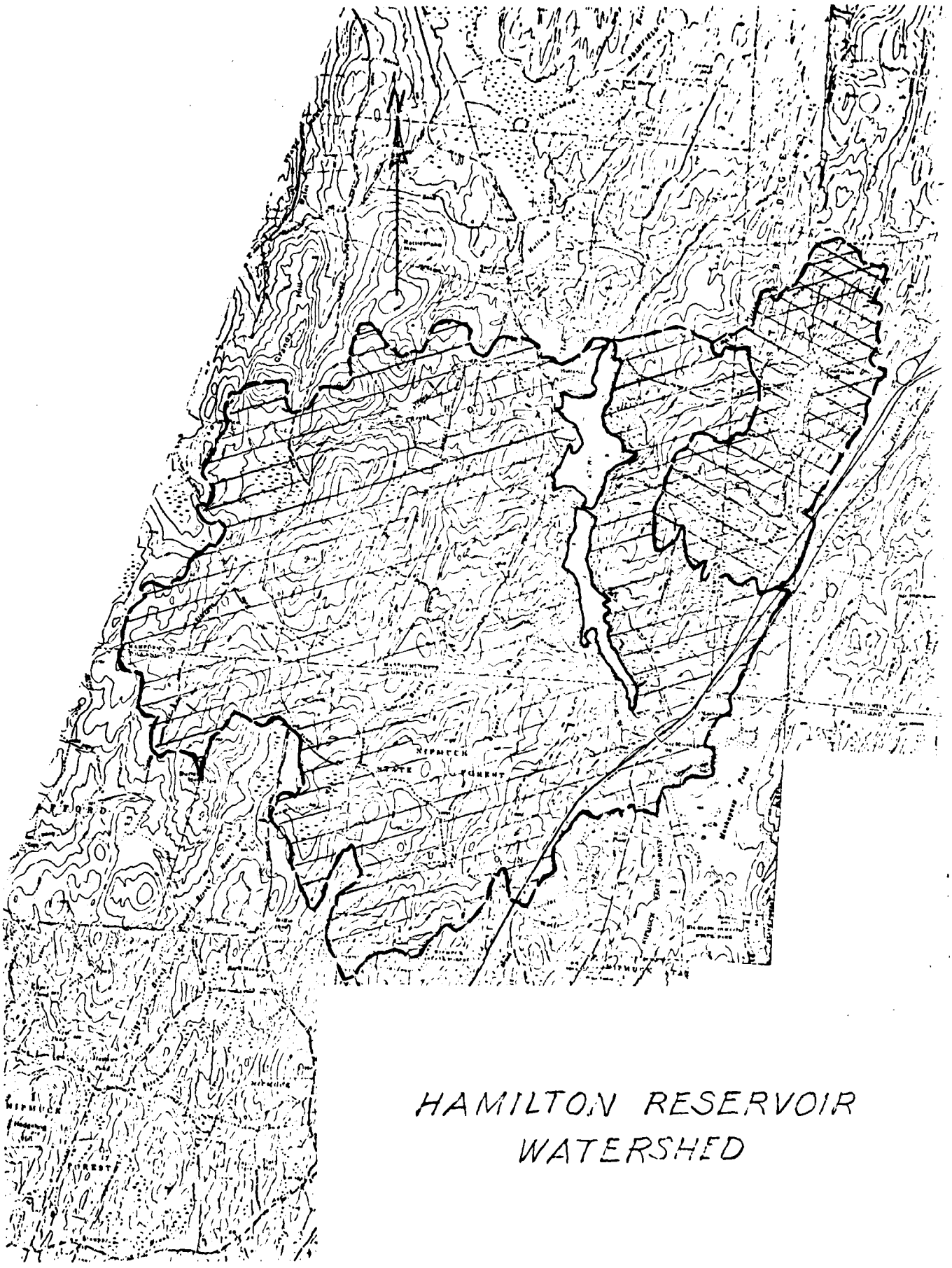


10. VIEW OF LOW LEVEL GATE OPERATING STAND.

REPRODUCED AT GOVERNMENT EXPENSE

HYDROLOGIC DATA AND COMPUTATIONS

APPENDIX D



HAMILTON RESERVOIR
WATERSHED

TAMS

Job No. 1497-19
Project Hamilton Reservoir
Subject

Sheet 1 of
Date Dec 20 78
By DLC
Ch'k. by

Sub-basin	Area mi^2	L mi	L_{CA} mi	LXA	L_{CA}XA
A	1.126	1.14	0.25	1.445	0.282
B	1.366	1.14	1.02	1.557	1.393
C	5.04	4.8	2.2	24.192	11.088
D	7.26	3.2	1.3	23.232	9.438
	14.792			50.426	22.201
Weighted				3.409	1.501

$t_p = C_t (L L_{CA})^{0.3}$

$= 2 (3.409 \times 1.501)^{0.3}$

$= 3.26$ hrs

$t_r = t_p / 5.6 = 0.58$ hrs 35.6 mins use 30 mins

$t_R = 0.5$

$t_{p_R} = t_p + 0.25(t_R - t_r)$

$= 3.26 + [0.25(-0.09)]$

$= 3.24$ hrs Say 3.25 hrs.

time to peak = 3.25 + .25 = 3.50 hrs.

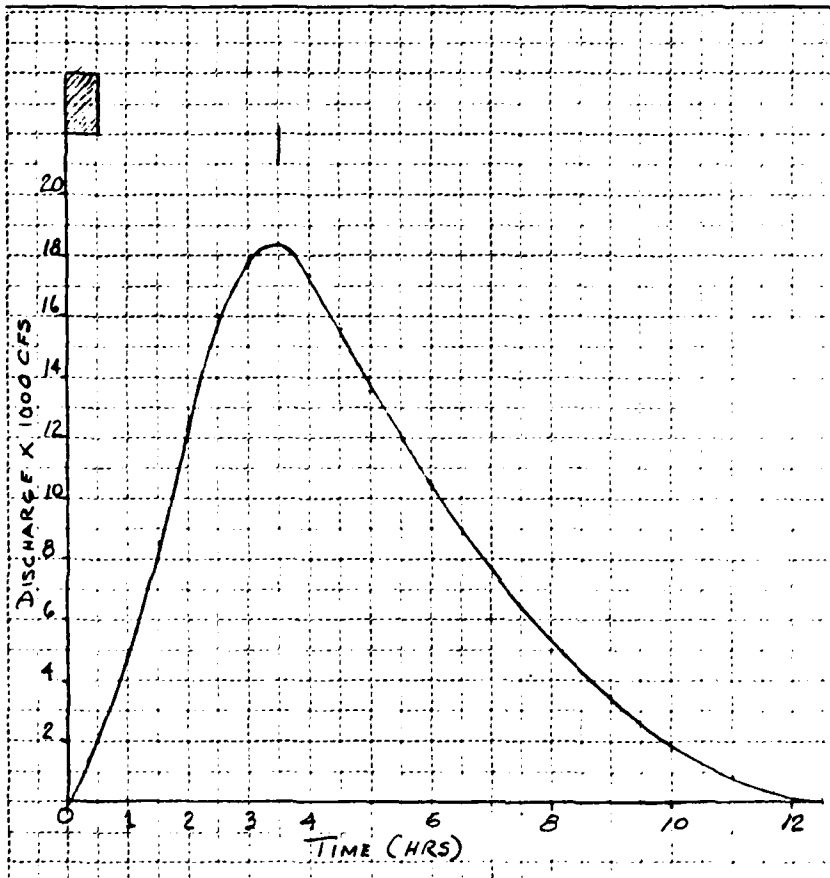
$Q_{p_R} = 640 C_p / t_{p_R} = 123.08$

$Q_{p_R} = 123.08 \times 14.792 \approx 1820$ cfs.

TAMS

Job No. 1497-19
Project HAMILTON RESERVOIR
Subject

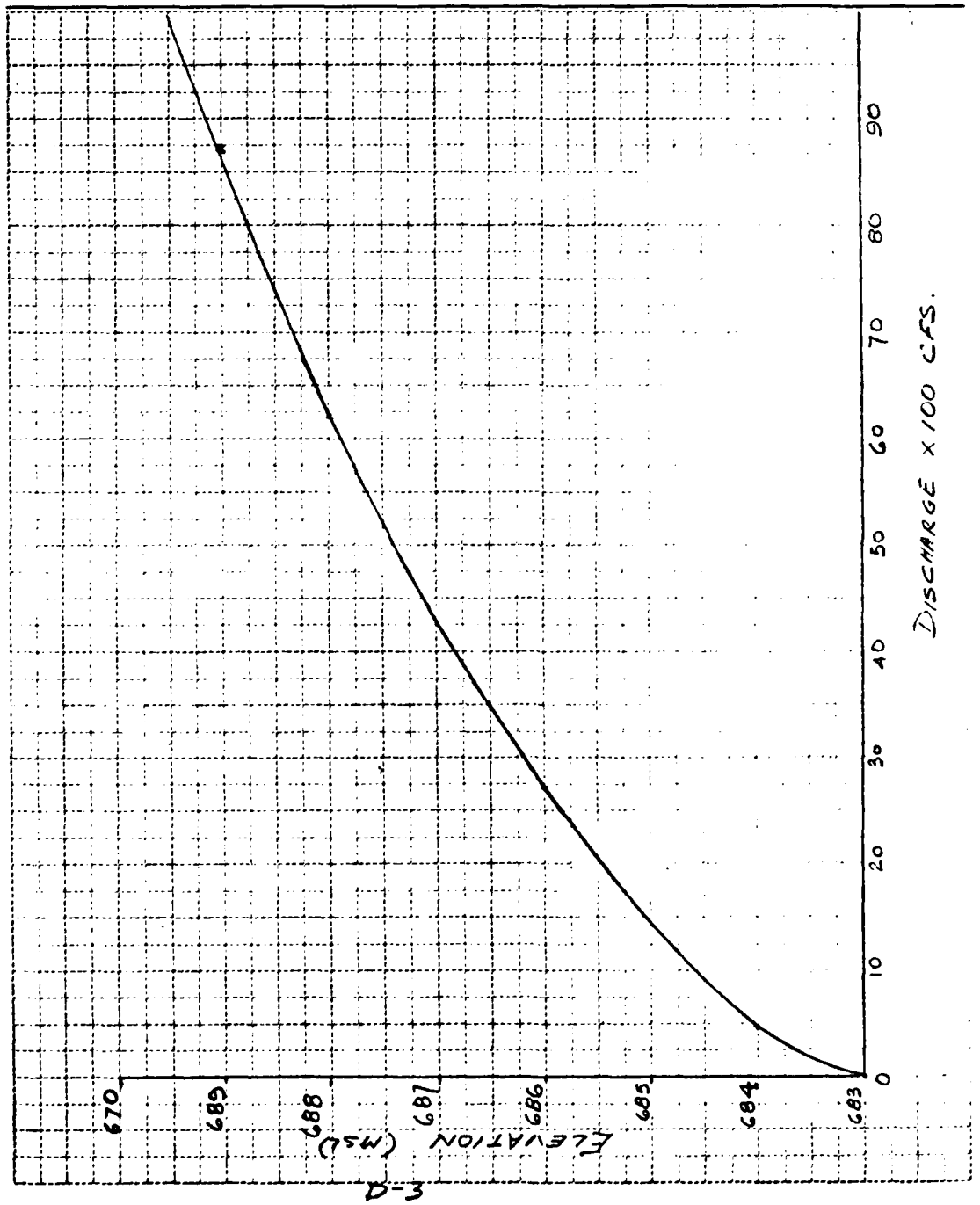
Sheet 2 of
Date Dec 20 78
By DLC
Ch'k. by



TAMS

Job No. 1497 - 19
Project HAMILTON RESERVOIR.
Subject

Sheet ____ of ____
Date DEC 26, 78
By D.L.C.
Ch'k. by



D-3

```
**********************************************************
*                                                        *
*  JOB NO..... 1497-19                                   *
*  DESCRIPTION..          HAMILTON RESERVOIR INFLOW HYDR *
*  USER NAME.... O-CV                                    *
*  DATE..... 10/26-78                                    *
*                                                        *
**********************************************************
```

FLOW ORDINATES(CFS) FOR UNIT HYDROGRAPH 1

TIME	FLOW	TIME	FLOW	TIME	FLOW	TIME	FLOW	TIME	FLOW	TIME	FLOW
0.00	0.00	0.50	200.00	1.00	490.00	1.50	850.00	1.99	1250.00	2.49	1599.99
2.99	1780.99	3.49	1820.00	3.99	1730.00	4.49	1570.00	4.99	1360.00	5.49	1200.00
5.99	1030.00	6.49	890.00	6.99	740.00	7.49	610.00	7.99	500.00	8.49	400.00
8.99	320.00	9.49	260.00	9.99	190.00	10.49	150.00	10.99	90.00	11.49	60.00
11.99	20.00										

D-5

TOTAL PRECIPITATION IN

TIME	PREC	TIME	PREC	TIME	PREC	TIME	PREC	TIME	PREC	TIME	PREC
0.50	0.56	1.00	0.63	1.50	0.97	1.99	1.69	2.49	3.09	2.99	3.12
3.49	2.15	3.99	1.37	4.49	0.93	4.99	0.79	5.49	0.74	5.99	0.67

THE TOT PREC FOR 5.99 HOURS= 16.81

PRECIPITATION EXCESS (IN)

APPLIED TO HYDROGRAPH NO. 1

TIME	PREC	TIME	PREC	TIME	PREC	TIME	PREC	TIME	PREC	TIME	PREC
0.50	0.56	1.00	0.63	1.50	0.97	1.99	1.69	2.49	3.09	2.99	3.12
3.49	2.15	3.99	1.37	4.49	0.93	4.99	0.79	5.49	0.74	5.99	0.67

THE TOT EXCESS PREC FOR 5.99 HOURS= 16.81

CALCULATED RUNOFF (CFS)

APPLIED TO HYDROGRAPH NO. 1

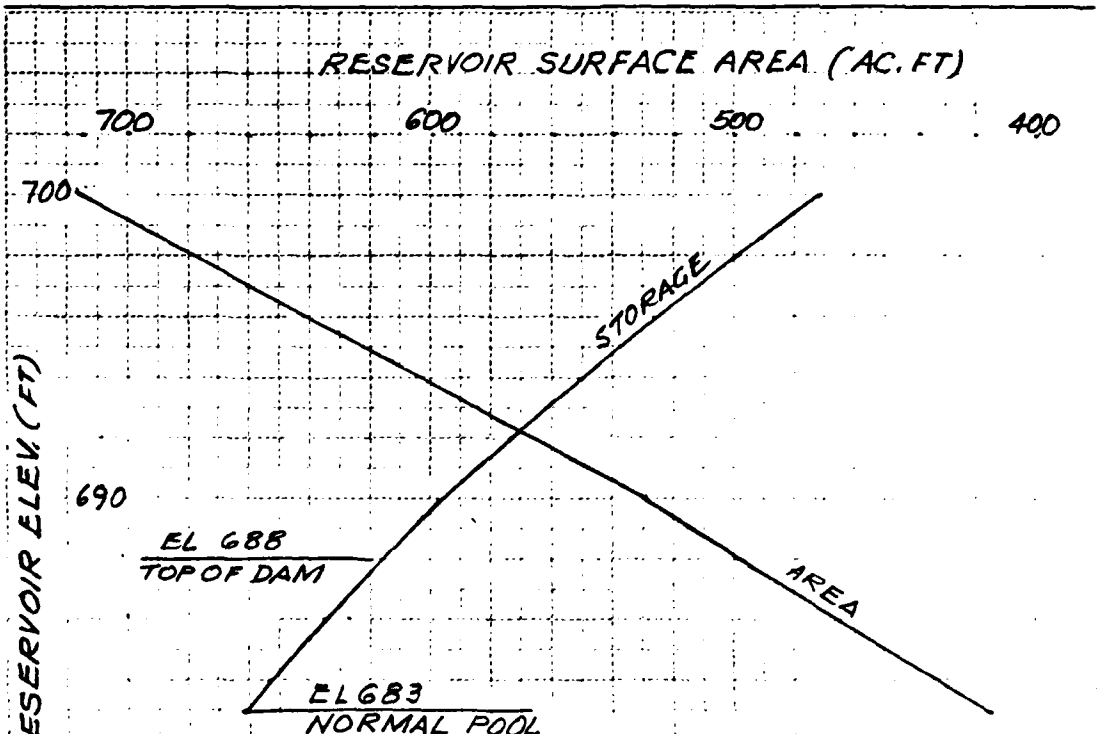
TIME	FLOW	TIME	FLOW	TIME	FLOW	TIME	FLOW	TIME	FLOW	TIME	FLOW
0.00	0.00	0.50	112.69	1.00	402.25	1.50	983.12	1.99	2058.26	2.49	3970.60
2.99	6823.44	3.49	10433.18	3.99	14445.75	4.49	18357.32	4.99	21587.10	5.49	23781.93
5.99	24546.05	6.49	24822.51	6.99	23913.98	7.49	22409.44	7.99	20493.30	8.49	18307.38
8.99	16001.23	9.49	13720.92	9.99	11574.35	10.49	9639.55	10.99	7940.82	11.49	6459.40
11.99	5159.64	12.49	4026.22	12.99	3051.84	13.49	2230.18	13.99	1550.90	14.49	1023.00
14.99	649.76	15.49	397.37	15.99	235.14	16.49	120.93	16.99	55.17	17.49	13.45

A-7

TIME (HOURS)	TOTAL RUN-OFF COMPUTED (CFS)	LAKE AREA RUN-OFF (CFS)	RUN-OFF CONTRIBUTIONS BY HYDROGRAPH 1 (CFS)	2 (CFS)	3 (CFS)	4 (CFS)	5 (CFS)
0.000	0.0	0.0	0.0				
0.500	631.3	519.6	112.6				
1.000	922.7	580.5	402.2				
1.500	1881.0	897.8	983.1				
1.999	3621.8	1563.5	2058.2				
2.499	6819.1	2948.4	3870.6				
2.999	9702.9	2879.4	6823.4				
3.499	12414.7	1981.5	10433.1				
3.999	15715.1	1269.4	14445.7				
4.499	19262.9	905.6	18357.3				
4.999	22322.4	735.3	21587.0				
5.499	24463.0	681.1	23781.9				
5.999	25465.2	619.2	24846.0				
6.499	24822.5	0.0	24822.5				
6.999	23913.9	0.0	23913.9				
7.499	22409.4	0.0	22409.4				
7.999	20493.3	0.0	20493.3				
8.499	18307.3	0.0	18307.3				
8.999	16001.2	0.0	16001.2				
9.499	13720.9	0.0	13720.9				
9.999	11574.3	0.0	11574.3				
10.499	9639.5	0.0	9639.5				
10.999	7940.8	0.0	7940.8				
11.499	6459.4	0.0	6459.4				
11.999	5159.6	0.0	5159.6				
12.499	4026.2	0.0	4026.2				
12.999	3051.8	0.0	3051.8				
13.499	2230.1	0.0	2230.1				
13.999	1550.9	0.0	1550.9				
14.499	1023.0	0.0	1023.0				
14.999	649.7	0.0	649.7				
15.499	397.3	0.0	397.3				
15.999	235.1	0.0	235.1				
16.499	120.9	0.0	120.9				

TAMS

Job No. 1497-19 Sheet 19 of ____
Project HAMILTON RESERVOIR Date 102578
Subject SAFETY INSPECTION By CV
Ch'k. by ____

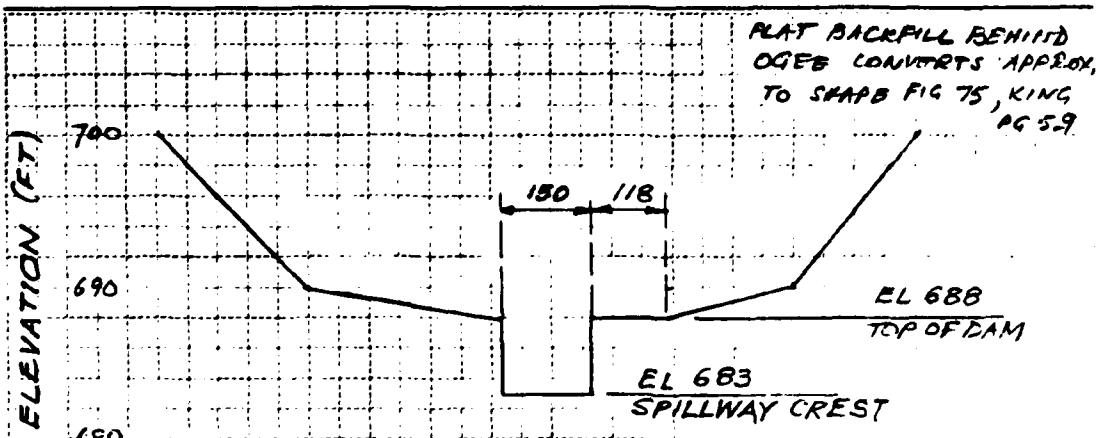


ELEV (FT)	AREA (ACRES)	ΔV (AC-FT)	TOTAL V (AC-FT)
683	416		1,918.4
684	432.1	424.	2342.4
686	464.4	896.5	3238.9
688	496.7	961.1	4200
690	529	1025.7	5225.7
692	566.2	1095.2	6320.9
694	603.4	1169.6	7490.5
696	640.6	1241.	8734.5
698	677.8	1318.4	10052.9
700	715	1392.8	11445.7

4200
1918.4
2281.6 AF
SURCHARGE STORAGE
$\frac{2281.6 \times 12}{9960} = 2.75''$

TAMS

Job No. 1497-19 Sheet 10 of ____
Project HAMILTON RESERVOIR Date 103178
Subject SAFETY INSPECTION By CV
Ch'k. by ____



	L=150			L=118								
ELEV	H	C	Q_{SP}	H	C	Q_D	L	ΔA	A	H	C	Q_A
683	0											
684	1	3.30	495									
686	3	3.49	2720									
688	5	3.7	6205	0			0	0	0			
689	6	3.7	8157	1	2.8	330	266	133	133	1.5	2.7	254
690	7	3.7	10279	2	3.1	1035	537	399	532	1.0	2.8	1490
692	9	3.7	14985	4	3.1	2926	622	1154	1686	2.71	3.0	8325
694	11	3.7	20248	6	3.1	5376	712	1334	3020	4.24	3.1	19270

EL	Q_{SP}	Q_D	Q_A	Q_T (cfs)	A (Ac. Ft)
683	0			0	1918.4
684	495			495	2342.4
686	2720			2720	3238.9
688	6205	0	0	6205	4200.
689	8157	330	254	8741	4712.8
690	10279	1035	1490	12804	5225.7
692	14985	2926	8325	26236	6320.9
694	20248	5376	19270	44894	7490.5

HAMILTON RESERVOIR

JOB NO. 1497-19 TAMS

HALF PMF

INPUT PARAMETERS

STARTING ELEV (FT.)	TIME INTERVAL (HOURS)	STARTING TIME (HOURS)	ENDING TIME (HOURS)	PRINT INTERVAL	GATE OPTION	PLOT OPTION	STORAGE COEF.	OUTFLOW COEF.	INFLOW COEF.	TIME COEF.	BREAK TIME
683.00	0.08	0.00	16.49	1	NO	YES	1.000	1.000	0.500	1.000	0.000

RESERVOIR ELEV. (FT.)	RESERVOIR STORAGE (ACFT)	RESERVOIR OUTFLOW (CFS)
683.00	1918.4001	0.00
684.00	2342.4003	495.00
686.00	3238.9003	2720.00
688.00	4200.0009	6205.00
689.00	4712.8007	8741.00
690.00	5225.7002	12804.00
692.00	6220.9004	26236.00
694.00	7490.5009	44894.00

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TIME (HRS)	INFLOW (CFS)	OUTFLOW (CFS)	STORAGE (ACFT)	ELEVATION (FT.)
0.00	0.00		1918.4001	683.00
0.08	52.39	0.20	1918.5791	683.00
0.17	104.79	0.83	1919.1145	683.00
0.25	157.19	1.87	1920.0036	683.00
0.33	209.59	3.31	1921.2436	683.00
0.41	261.99	5.17	1922.8317	683.01
0.50	314.39	7.43	1924.7653	683.01
0.58	344.12	9.99	1926.9641	683.02
0.66	373.29	12.77	1929.3464	683.02
0.75	402.46	15.77	1931.9089	683.03
0.83	431.64	18.97	1934.6503	683.03
0.91	460.81	22.37	1937.5693	683.04
1.00	489.98	25.99	1940.6643	683.05
1.08	562.35	29.98	1944.0815	683.06
1.16	636.90	34.52	1947.9733	683.06
1.24	711.46	39.62	1952.3435	683.08
1.33	786.01	45.28	1957.1879	683.09
1.41	860.56	51.48	1962.5034	683.10
1.49	935.12	58.23	1968.2956	683.11
1.58	1074.82	65.79	1974.7536	683.13
1.66	1219.59	74.41	1982.1418	683.15
1.74	1364.37	84.12	1990.4602	683.17
1.83	1509.15	94.91	1999.7014	683.19
1.91	1653.93	106.77	2009.8581	683.21
1.99	1798.70	119.69	2020.9228	683.24
2.07	2053.90	134.10	2033.2656	683.27
2.16	2319.27	150.47	2047.2883	683.30
2.24	2584.65	168.82	2063.0122	683.34
2.32	2850.02	189.15	2080.4238	683.39
2.41	3115.39	211.43	2099.5092	683.42
2.49	3380.76	235.65	2120.2558	683.47
2.57	3622.04	261.70	2142.5708	683.52
2.66	3862.29	289.47	2166.3525	683.58
2.74	4101.65	318.92	2191.5800	683.64
2.82	4341.00	350.05	2218.2417	683.70
2.90	4580.36	382.83	2246.3256	683.77
2.99	4819.71	417.27	2275.8208	683.84
3.07	5046.69	453.29	2306.6738	683.91
3.15	5271.77	490.82	2338.8252	683.99
3.24	5496.85	568.79	2372.1342	684.06
3.32	5721.93	653.88	2406.4174	684.14
3.40	5947.02	741.33	2441.6528	684.22
3.49	6172.10	831.10	2477.8242	684.30
3.57	6439.38	923.50	2515.0561	684.39
3.65	6712.31	1018.91	2553.4965	684.47
3.73	6986.25	1117.33	2593.1513	684.55
3.82	7260.19	1218.71	2634.0000	684.65
3.90	7534.12	1323.00	2676.0219	684.74
3.98	7808.06	1430.16	2719.1977	684.84

TIME (HRS)	INFLOW (CFS)	OUTFLOW (CFS)	STORAGE (ACFT)	ELEVATION (FT.)
4.07	8098.81	1540.27	2763.5649	684.93
4.15	8393.27	1653.47	2809.1733	685.04
4.23	8687.73	1769.72	2856.0146	685.14
4.32	8982.19	1888.98	2904.0683	685.25
4.40	9276.66	2011.20	2953.3134	685.36
4.48	9571.12	2136.33	3003.7299	685.47
4.56	9833.36	2264.05	3055.1889	685.59
4.65	10027.29	2393.96	3107.5346	685.70
4.73	10341.23	2525.97	3160.7236	685.82
4.81	10595.16	2660.04	3214.7421	685.94
4.90	10849.10	2831.02	3269.5180	686.06
4.98	11103.03	3031.11	3324.6997	686.17
5.06	11298.18	3231.80	3380.0468	686.29
5.15	11475.85	3432.14	3435.2973	686.40
5.23	11653.52	3631.92	3490.3940	686.52
5.31	11831.20	3831.17	3545.3413	686.63
5.39	12008.87	4029.88	3600.1420	686.75
5.48	12186.54	4228.07	3654.8002	686.86
5.56	12293.66	4424.59	3709.0805	686.97
5.64	12376.84	4619.22	3762.6718	687.08
5.72	12460.02	4810.81	3815.5102	687.19
5.81	12543.20	4999.75	3867.6142	687.30
5.89	12626.38	5186.08	3919.0019	687.41
5.98	12709.57	5369.88	3969.6909	687.52
6.06	12694.09	5550.00	4019.3637	687.62
6.14	12645.74	5724.84	4067.5835	687.72
6.22	12587.39	5894.08	4114.2568	687.82
6.31	12534.04	6057.85	4159.4218	687.91
6.39	12480.69	6220.38	4203.1113	688.00
6.47	12427.34	6428.29	4245.1533	688.08
6.56	12359.59	6627.23	4285.3808	688.16
6.64	12283.18	6817.14	4323.7812	688.24
6.72	12207.77	6998.19	4360.3916	688.31
6.81	12132.36	7170.69	4395.2724	688.38
6.89	12056.96	7334.92	4428.4814	688.44
6.97	11981.55	7491.16	4460.0742	688.50
7.05	11872.79	7639.12	4489.9922	688.56
7.14	11747.91	7779.24	4518.1240	688.62
7.22	11623.03	7908.56	4544.4755	688.67
7.30	11498.16	8030.37	4569.1064	688.71
7.39	11373.28	8143.95	4592.0732	688.76
7.47	11248.41	8249.58	4613.4316	688.80
7.55	11101.32	9347.15	4633.1611	688.84
7.64	10942.28	8436.36	4651.2002	688.87
7.72	10783.25	8517.28	4667.5644	688.91
7.80	10624.21	8590.21	4682.3105	688.94
7.88	10465.17	8655.40	4695.4922	688.96
7.97	10306.14	8713.11	4707.1611	688.98
8.05	10133.08	8776.68	4717.3056	689.00
8.13	9951.65	8843.62	4725.7558	689.02

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MOORE BUSINESS FORMS, INC. PRINTED IN USA 22

TIME (HRS)	INFLOW (CFS)	OUTFLOW (CFS)	STORAGE (ACFT)	ELEVATION (FT.)
8.22	9770.23	8897.42	4732.5478	689.03
8.30	9538.80	8938.78	4737.7685	689.04
8.39	9407.37	8968.36	4741.5019	689.05
8.47	9225.94	8986.78	4743.8271	689.06
8.55	9038.51	8994.47	4744.7978	689.06
8.63	8847.11	8991.73	4744.4521	689.06
8.71	8655.71	8979.02	4742.8476	689.05
8.80	8464.31	8956.85	4740.0498	689.05
8.88	8272.90	8925.74	4736.1220	689.04
8.96	8081.50	8886.15	4731.1240	689.03
9.05	7891.33	8838.55	4725.1162	689.02
9.13	7702.07	8783.45	4718.1601	689.01
9.21	7512.80	8720.63	4710.2998	688.99
9.30	7323.53	8654.91	4701.4609	688.97
9.38	7134.27	8636.35	4691.6406	688.95
9.46	6945.00	8583.09	4680.8711	688.93
9.54	6761.88	8525.40	4669.2050	688.91
9.63	6583.72	8463.60	4656.7099	688.89
9.71	6405.56	8397.93	4643.4296	688.86
9.79	6227.40	8328.50	4629.3906	688.83
9.88	6049.23	8255.44	4614.6181	688.80
9.96	5871.07	8178.89	4599.1377	688.77
10.04	5702.21	8099.09	4583.0029	688.74
10.13	5541.63	8016.47	4566.2949	688.71
10.21	5381.04	7931.24	4549.0615	688.68
10.29	5220.46	7843.50	4531.3193	688.64
10.37	5059.87	7753.33	4513.0859	688.61
10.46	4899.29	7660.81	4494.3779	688.57
10.54	4748.59	7566.18	4475.2441	688.53
10.62	4607.60	7469.85	4455.7646	688.49
10.71	4466.61	7372.03	4435.9843	688.46
10.79	4325.62	7272.77	4415.9130	688.42
10.87	4184.62	7172.12	4395.5605	688.38
10.96	4043.63	7070.12	4374.9355	688.34
11.04	3911.31	6966.96	4354.0771	688.30
11.12	3788.35	6862.99	4333.0537	688.25
11.20	3665.40	6758.39	4311.9013	688.21
11.29	3542.44	6653.17	4290.6259	688.17
11.37	3419.49	6547.36	4269.2304	688.13
11.45	3296.53	6440.98	4247.7197	688.09
11.54	3190.46	6334.16	4226.1201	688.05
11.62	3072.58	6227.17	4204.4853	688.00
11.70	2964.70	6119.56	4182.7812	687.96
11.79	2856.83	6013.16	4160.8857	687.91
11.87	2748.95	5903.07	4138.7968	687.87
11.95	2641.07	5792.29	4116.5205	687.82
12.03	2539.16	5680.92	4094.0800	687.77
12.12	2445.09	5739.14	4071.5273	687.73
12.20	2351.02	5657.07	4048.8916	687.68
12.28	2256.94	5574.69	4026.1743	687.63

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TIME (HRS)	INFLOW (CFS)	OUTFLOW (CFS)	STORAGE (ACFT)	ELEVATION (FT.)
12.37	2162.87	5492.03	4003.3779	687.59
12.45	2068.80	5409.09	3980.5044	687.54
12.53	1980.11	5325.94	3957.5737	687.49
12.62	1899.24	5242.75	3934.6318	687.44
12.70	1818.37	5159.62	3911.7055	687.40
12.78	1737.50	5076.55	3888.7949	687.35
12.86	1656.63	4993.53	3865.8989	687.30
12.95	1575.75	4910.56	3843.0175	687.25
13.03	1499.75	4827.70	3820.1669	687.20
13.11	1431.55	4745.11	3797.3891	687.16
13.20	1363.35	4662.87	3774.7089	687.11
13.28	1295.16	4580.97	3752.1240	687.06
13.36	1226.96	4499.41	3729.6318	687.02
13.45	1158.77	4418.18	3707.2299	686.97
13.53	1094.22	4337.33	3684.9311	686.92
13.61	1038.44	4256.98	3662.7724	686.88
13.69	982.06	4177.22	3640.7758	686.83
13.78	925.66	4098.03	3618.9379	686.79
13.86	869.30	4019.41	3597.2544	686.74
13.94	812.92	3941.33	3575.7216	686.70
14.03	760.76	3863.83	3554.3501	686.65
14.11	716.94	3787.06	3533.1782	686.61
14.19	673.13	3711.10	3512.2299	686.56
14.28	629.31	3635.93	3491.4995	686.52
14.36	585.50	3561.53	3470.9814	686.48
14.44	541.69	3487.88	3450.6704	686.44
14.52	501.86	3415.02	3430.5752	686.39
14.61	470.98	3343.07	3410.7338	686.35
14.69	439.90	3272.13	3391.1699	686.31
14.77	408.93	3202.17	3371.8764	686.27
14.86	377.95	3133.17	3352.8471	686.23
14.94	346.97	3065.11	3334.0756	686.19
15.02	313.87	2997.98	3315.5649	686.15
15.11	297.92	2931.91	3297.3432	686.12
15.19	276.97	2866.95	3279.4272	686.08
15.27	256.03	2803.06	3261.8090	686.04
15.35	235.08	2740.23	3244.4819	686.01
15.44	214.13	2691.47	3227.4082	685.97
15.52	195.15	2649.49	3210.4941	685.93
15.60	181.68	2607.95	3193.7548	685.89
15.69	168.22	2566.88	3177.2065	685.86
15.77	154.75	2526.27	3160.8461	685.82
15.85	141.29	2486.13	3144.6704	685.78
15.94	127.82	2446.43	3128.6762	685.75
16.02	115.31	2407.19	3112.8637	685.71
16.10	105.83	2368.42	3097.2431	685.68
16.19	96.35	2330.15	3081.8217	685.64
16.27	86.87	2292.36	3066.5961	685.61
16.35	77.39	2255.05	3051.5634	685.58
16.43	67.91	2218.21	3036.7197	685.54
MAX. VALUES	12709.57	8994.47		689.06

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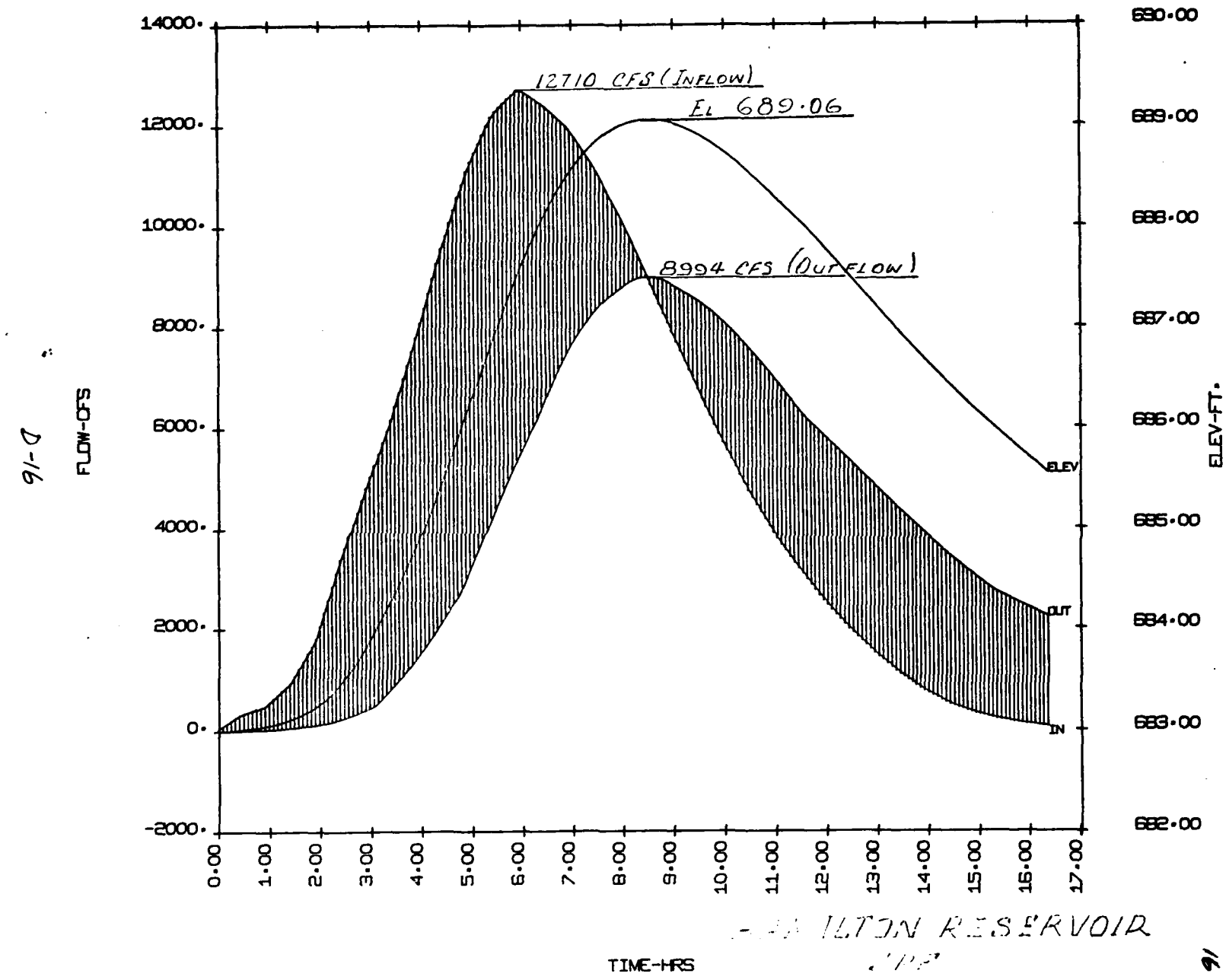

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ILTON RESERVOIR

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INFORMATION AS CONTAINED IN THE
NATIONAL INVENTORY OF DAMS

APPENDIX E

END

FILMED

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